MODERN PLASTICS



DECEMBER 1941



The Hoarse Shriek That Means All's Well!



A WHISTLE WAILS and echoes through the night. It's 10:05 in the village so everybody knows that's the *Limited* thundering into the bend down by the creek.

And once again a Durez plastic has served faithfully and well.

What have plastics to do with the 408,350 miles of steel track, sprawling like a web over the nation?

Speeding human life, mail and freight almost automatically over this intricate network is the herculean task of modern signals and controls. In devices known as relays, hidden in the heart of these controls, plastics have become an integral part.

All along the line these relays operate signals and switches; automatically reveal the position of every train; record these movements on master controls at the terminal, miles away!

Engineers, like those of General Railway Signal Company, who have been instrumental in developing these controls, have found in Durez plastics the answer to design simplification and increased efficiency. Compactness, interchangeability, self-insulation, strength, and even beauty have been incorporated into these systems by the adoption of plastics. From cams and caps to insulation blocks and code transmitter parts . . . Durez plastics are the standard material *today*.

Do your future plans call for product simplification with increased efficiency? Durez can serve *you*.

DUREZ PLASTICS and CHEMICALS

PLASTICS THAT FIT THE JOB

DUREZ PLASTICS & CHEMICALS, INC. DUREZ 32 WALCK ROAD, N. TONAWANDA, N. Y.



Catalin

Greater Today than Yesterday . . . Greater Tomorrow than Today!

We are happy to announce that our 1941 plant expansion plans have been completed in every detail. Because of these greatly extended facilities we are now ready, for approved uses, to produce Catalin in quantities larger than ever before.

Our new Polystyrene plant has already begun operation and is turning out an ever-increasing daily volume of highly desirable molding compounds. Catalin liquid resins for laminating, bonding and glueing are also doing their part to meet the needs for both defense and essential civilian industries. Catalin's technical cast resin is rapidly establishing itself as a superior material for chemical-resistant tanks, feed lines, water pump gears, submarine dials, etc.

The manufacturing problems and priority regulations affecting the chemical industry are changing almost daily, but we are confident that the productive capacity of our great country will shortly overtake the defense demands and that phenol and formaldehyde will be available in sufficient quantities for civilian requirements.

In the interim, Catalin gladly offers its engineering and technical experience to those manufacturers who are planning to participate in the bright future of plastics!

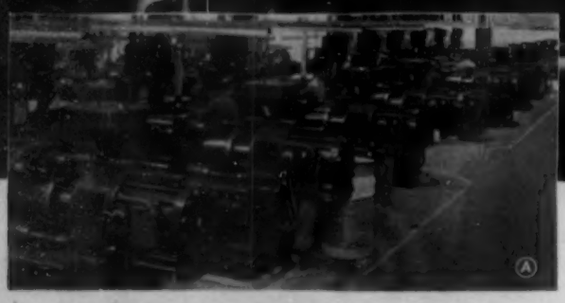
CATALIN CORPORATION

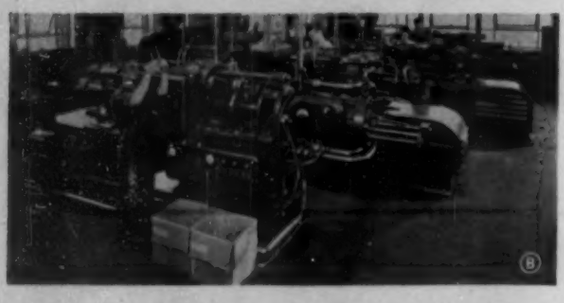
ONE PARK AVENUE, NEW YORK, N. Y.

Catalin

MORE AND MORE INSTALLATIONS GO *REED-PRENTICE*




(A)


(B)


(C)


(D)

AND THAT'S NOT JUST TALK!

The ever growing list of Reed-Prentice installations is unmistakable evidence of this trend.

To merit such confidence calls for carefully selected materials combined with skillful craftsmanship, all backed by over 75 years of experience in building high quality machine tools. This combination, plus latest factory methods and equipment, assure our customers outstanding performance from their Reed-Prentice Injection Machines, with flexibility of set-up and operation and uniformity of product hard to beat.

The experience of all our customers is best summed up in the words of one leading molder who has standardized on Reed-Prentice machines —"Originally considered best from investigation, and since borne out by performance and service."

We shall be pleased to submit detailed proposals at any time — without any obligation, of course.

SPECIFICATION TABLE

MODEL NUMBERS	10A-4	10D-6	10D-8
Capacity at Standard Pressure	4 oz.	6 oz.	8 oz.
*Standard Injection Pressure (per sq. in.)	20,000 lbs.	20,000 lbs.	20,000 lbs.
Mold Closing Pressure	225 tons	325 tons	325 tons
Mold Opens	10¼"	10¼"	10¼"
Weight without Motor and Control	10,000 lbs.	11,500 lbs.	12,000 lbs.

*Higher pressures also available.

51 Reed-Prentice Injection Machines, illustrated in part at left, are serving these four prominent molders.

(A) Fuller Brush Co., Hartford, Connecticut.
(B) Elmer E. Mills Corp., Chicago, Illinois.
(C) A Massachusetts company, excelling in the plastics field.
(D) Columbia Protektosite Co., Carlstadt, N. J.

Reed-Prentice features covered by Patents Pending.

REED - PRENTICE CORP.

WORCESTER, MASS. U.S.A. NEW YORK OFFICE 75 WEST ST.

457 MACHINES IN SUCCESSFUL OPERATION

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modern plastics



Merrie Christmas

Time out from trying to meet priorities, time out from the rush of Defense orders, time out from the bustle of getting orders! This is the month that has December 25th on the calendar. Put a big red ring on that date and join with us in wishing a Merry Christmas and a very Happy New Year to all our readers and the plastics industry.

In January—more defense news! In view of the rapidly changing conditions in the industry, we will publish a resumé of what has taken place this year and attempt to make a forecast for next year.

Also in this issue will be an important article, "Resin-bonded friction materials," by the Engineering staff of Johns-Manville.

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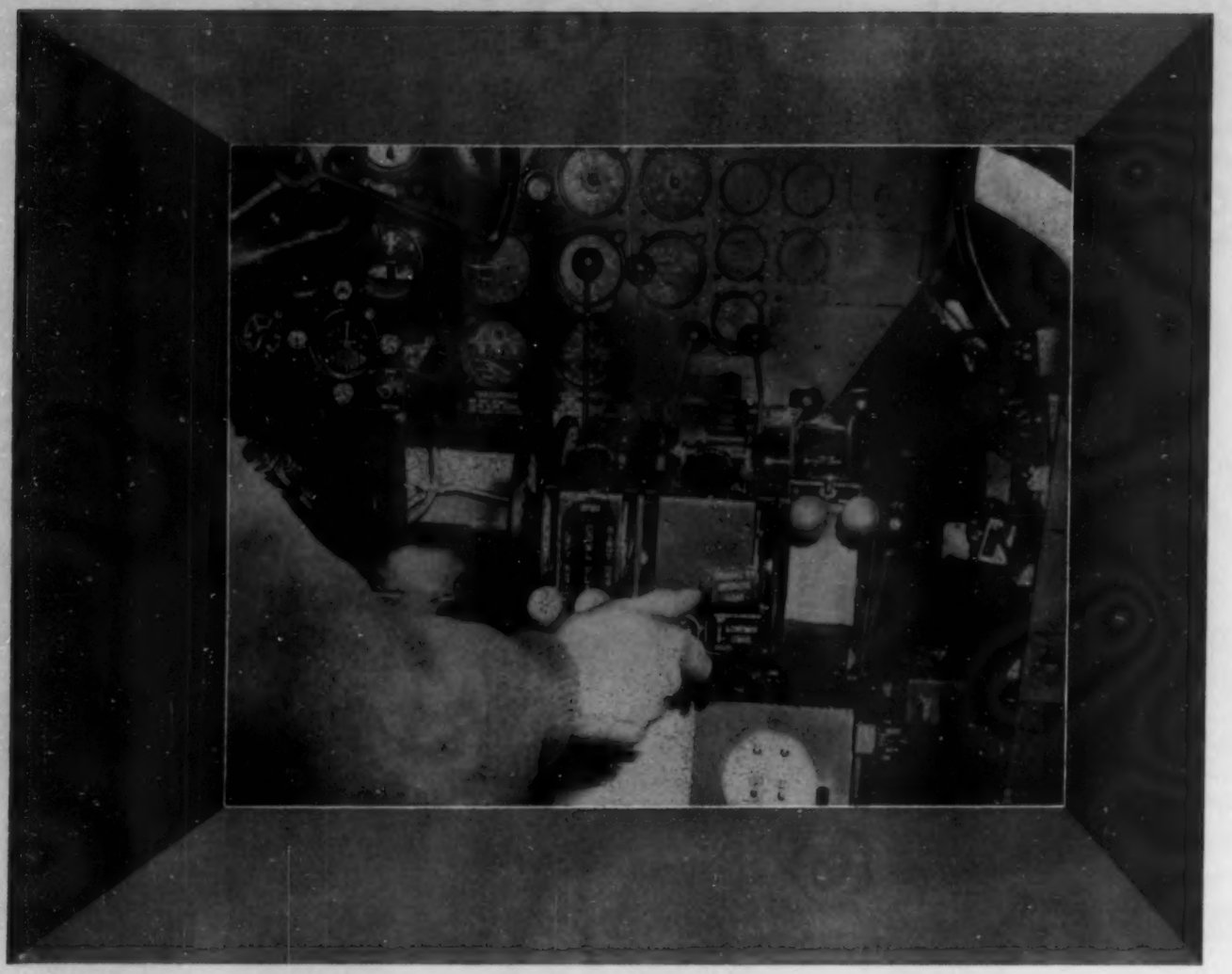
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Cover colors this month, HORSE-SHOE RED and WINDWARD GREEN (Created by Textile Color Card Association)

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Eyes, Ears, *and the Seat of his Pants*

No longer is it necessary for the airman to fly only by his "Eyes, Ears, and the Seat of his Pants." Today half a hundred instruments before his eyes silently speak to him, while INSUROK-topped controls at his finger tips give him complete mastery of his craft at all times. INSUROK Precision Plastics are equally at home aloft, afloat, ashore . . . in delicate precision instruments, or in heavy power drives of giant machines . . . delivering always the same trouble-free, dependable performance.

Precision **INSUROK**

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INSUROK Molded or Laminated • **EBROK** Battery Containers • **RUB-TEX** Molded Hard Rubber • **RUB-EROK** Hard Rubber Electrical Insulation • **MICAROK** Sheet Mica

Stradivarius would approve...

THIS BIG ASSIST FROM DU PONT "LUCITE"!



DEFT old Stradivarius (1644-1737)—greatest of all violin craftsmen—would have welcomed "Lucite" methyl methacrylate resin. For chin rests made of "Lucite" overcome the objections of fiddlers to rubber, ebony and other woods.

In crystal-clear, black, opaque, transparent amber and tortoise shell, the new Kleerest, molded from "Lucite," is winning bravos. It is sanitary, odorless and light in weight. Warm to the touch and smooth, it has the desirable property of clinging to the chin, thus giving a violinist a surer grip on his instrument.

Overcoming the handicaps of other materials is often accomplished by the additional properties of "Lucite." It is strong and tough . . . resists shattering and chipping . . . holds metal inserts securely, as in the chin rest . . . retains its shape after molding. "Lucite" is light in weight and sparklingly clear. And it resists outdoor exposure and the attacks of many chemicals.

Think of the big things these properties of "Lucite" can do for your product. Now is the time to investigate "Lucite" and other Du Pont plastics for future applications. Experimental samples and Du Pont Technical service are at your disposal. E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Arlington, New Jersey.

"Lucite" is Reg. U. S. Pat. Off.

DU PONT

PLASTICS

A STATEMENT BY DU PONT ABOUT PLASTICS

• Defense requirements and unusual commercial demands exceed the supply of some Du Pont plastics. National Defense orders will get preferred attention, of course. But Du Pont is bending every effort to satisfy commercial and replacement needs. Shortages of equipment and raw materials necessarily limit this effort.

Du Pont is also instituting a broad research and development program. We believe that from this program will come improvements in existing plastics and the creation of entirely new types with new and valuable properties. The results of this research will be reported to you as they develop.

Stories of Du Pont plastics applications and developments will continue to appear in advertisements. We hope you will find it helpful to apply this information to your present and future needs. Meanwhile, Du Pont technicians are ready to devote their knowledge and facilities to your product problems.

Completely Milled - TWO SIDES ..WITHOUT MODELS OR TEMPLATES!





. . . A TYPICAL EXAMPLE OF THE VERSATILITY AND SPEED OF THE MILWAUKEE ROTARY HEAD TOOL AND DIE MILLING MACHINE

The steel block, shown above, with its variety of geometric forms, was milled completely on both sides, without models or templates, in one setup on the Milwaukee Model D Rotary Head Tool and Die Milling Machine. At no time during the entire milling process was either block moved from its original position in the milling machine vise. This is another example of speed and versatility of a Milwaukee Model D — the machine that transmits blueprint into steel in a single setup — layout, milling, drilling, precision boring and slotting operations.

Investigate this machine and the new technique it offers for the production of dies and tools — in far less time, with positive accuracy, and at very low cost.

KEARNEY & TRECKER CORPORATION
MILWAUKEE WISCONSIN, U. S. A.



Milwaukee MODEL D ROTARY HEAD TOOL AND DIE MILLING MACHINE

Milwaukee MILLING MACHINES

SHORTAGES?



That's where we came in!

In 1869, there was a shortage of ivory. People wanted something to take its place. So we developed the first plastic—Celluloid.

Since that time we have developed other plastics, and have pioneered the way for a long list of companies who have since entered the plastics field.

Today, shortage of raw materials is again a vital problem to most manufacturers.

On certain types of the materials we make, we have more orders than we can fill. But that's no reason to sit back and twiddle our thumbs. Our job is to push forward—now as in 1869.

By drawing on the imagination that got this business started, we can solve, and are solving, many problems of material supply. We hope to solve many more before this emergency is over. Your problem may be among them. Even if we can't meet your requirements today, we will be glad to try to act as your "ear to the ground"—advising you as accurately as possible on the raw material situation in our field. Your inquiry will receive the prompt, careful attention you want. On orders, if you have priority certificates, please send them along.

Celluloid Corporation

Celluloid Corporation, 180 Madison Ave., New York City. Sole Producer of Celluloid* (cellulose nitrate), Lumarith* (cellulose acetate), Lumarith Protectoid* (transparent packaging material), H-Scale* (synthetic pearl essence), Lindol* (plasticizer and lubricant additive), Samson* and Safety Samson* Film Bases, and Vimlite* (flexible health glass). *Trademarks Reg. U. S. Pat. Off.


It Never Won a
Modern Plastics
Competition, But
PHENOLIC TENSILE TEST SPECIMEN—A. S. T. M. D638-41T.



It's the Key to the Future of the Industry

This little piece of plastic was not among last month's winners in the Modern Plastics Competition. You couldn't sell it to the public—or even give it away. And yet, insignificant as it appears, it and thousands of others like it may well shape the future of the plastics industry.

It is a test specimen. Nothing unusual about it except its shape. Yet in the hands of skilled technicians and with the aid of modern precision testing equipment it will tell a story that will reveal its possibilities and limitations. Only with the knowledge of these can it gain its rightful place in modern industry.

Pioneer builders of many of the machines which are now standard equipment for testing soils, asphalt, concrete, wood and metals; producers of the accepted testing machine for the cement industry; and developers of the high magnification stress-strain recorder Baldwin Southwark is in a unique position to contribute to the advancement of plastics testing. With the cooperation of the Industry we are applying to the development of this specialized equipment the knowledge acquired by our organization through long years of experience in the materials testing field.

Baldwin Southwark

BLW THE BALDWIN GROUP

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ONLY *Experience* EARNS SERVICE STRIPES

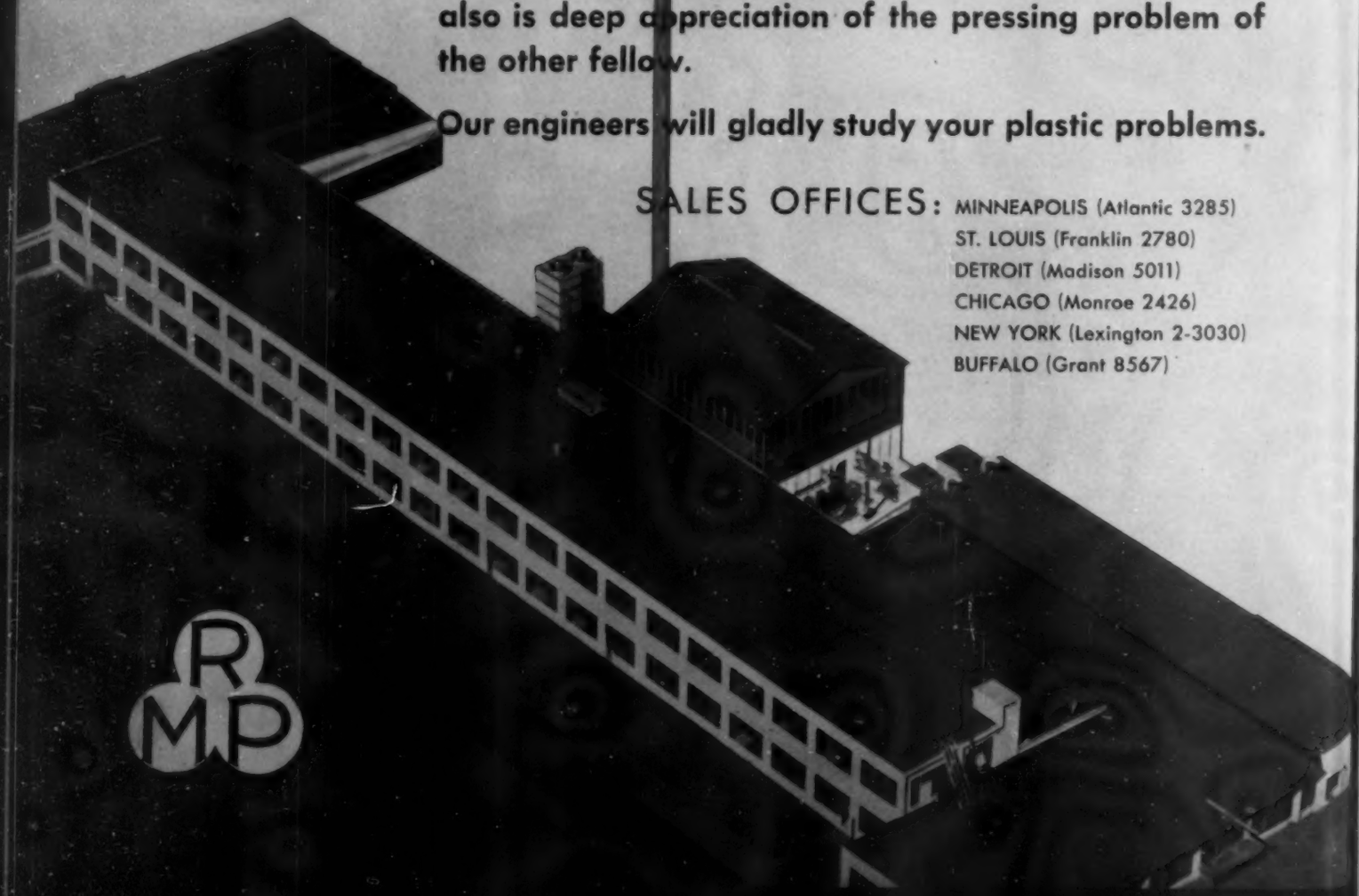
In 21 years of hard-won experience, Reynolds Molded Plastics has earned its service stripes . . . and is earning new ones every production-filled day.

At Reynolds, plastic molding means resourcefulness—skilled and adaptable engineers—experienced workmen—modern equipment and determination to protect customers' interests.

Besides the ability to give you what you want, here also is deep appreciation of the pressing problem of the other fellow.

Our engineers will gladly study your plastic problems.

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R M P

REYNOLDS MOLDED PLASTICS

CAMBRIDGE, OHIO, U. S. A.

DIVISION: REYNOLDS SPRING COMPANY • JACKSON, MICHIGAN, U. S. A.

WALKER-TURNER RADIAL DRILL



Showing range of Walker-Turner Radial Drill, which drills to center of 62" circle.

Head tilts up to 45° left or right.

For
DRILLING
TAPPING
ROUTING
LIGHT
PROFILING

$355

(Including Motor)
Steel Stand $27.50 extra
F.O.B. Plainfield, N.J.

Jacobs Chuck: ½" capacity or No. 1 Morse Taper.
Spindle Speeds: four—from 600 to 5000 r.p.m. with 1740 r.p.m. motor. Eight speeds—from 600 to 10,000 r.p.m. with two-speed 1740—3500 r.p.m. three phase motor with push button control.
Overall Dimensions: height 72", width 31", depth 58"
Shipping weight 450 lbs.
Ball Bearing Mounted: sliding ram carried on 8 precision ball bearings with provision for take-up for wear.
Six Spline Spindle: four precision ball bearings. Drive pulley straddle-mounted to eliminate belt strain.
Capacity: to center of 62" circle. Distance nose of chuck to table 13½". Traverse of spindle 3¼". Column diameter 3⅜".
Miscellaneous: drill may be tilted to 45° right or left. Drill press head cast in one piece. Run-out accuracy guaranteed within all industrial standards. Extremely rigid when locked in drilling position. Minimum deflection.

• PROMPT DELIVERY to plants engaged in defense production

Versatile, speedy, accurate—Walker-Turner Radial Drills have made themselves indispensable to many Defense industries—aircraft, shipbuilding, tank manufacturing, tool making, and etc. In the interests of National Defense, first consideration in delivery necessarily is given to high priority ratings. Immediate shipment of these Radial Drills is made to concerns engaged in Defense production. However, our enlarged facilities and three-shift manufacturing schedule enable us to make reasonably prompt shipment to plants with low priority ratings.

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☐ Send complete details on Radial Drill
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FOR METAL, WOOD AND PLASTICS

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EVEN OSTRICHES··

are numbered!

There's just no point in trying to hide from the truth.

Everybody between 21–35 has a draft number. Every business has been tagged, too, and everything you make—with AIA or down the line right into forbidden territory.

They're even hanging numbers on the ostriches—the guys who're "different"—no metal can touch them—they don't believe in OPM or OPACS. And the ostriches are getting the worst of the bargain.

Those plastics users who have faced facts and taken full advantage of the government offices placed at their disposal have suffered in varying degree. But their sufferings are as naught to those of the guys who just stuck their heads in a barrel of molding powder and tried to forget. We can't help you if you don't try to help yourself.

See your local OPM office for further details.

"A Ready Reference for Plastics" written for the layman, is now in a new edition. If you are a user, or a potential user of molded plastics, write us on your letterhead for a copy of this plain non-technical explanation of their uses and characteristics.



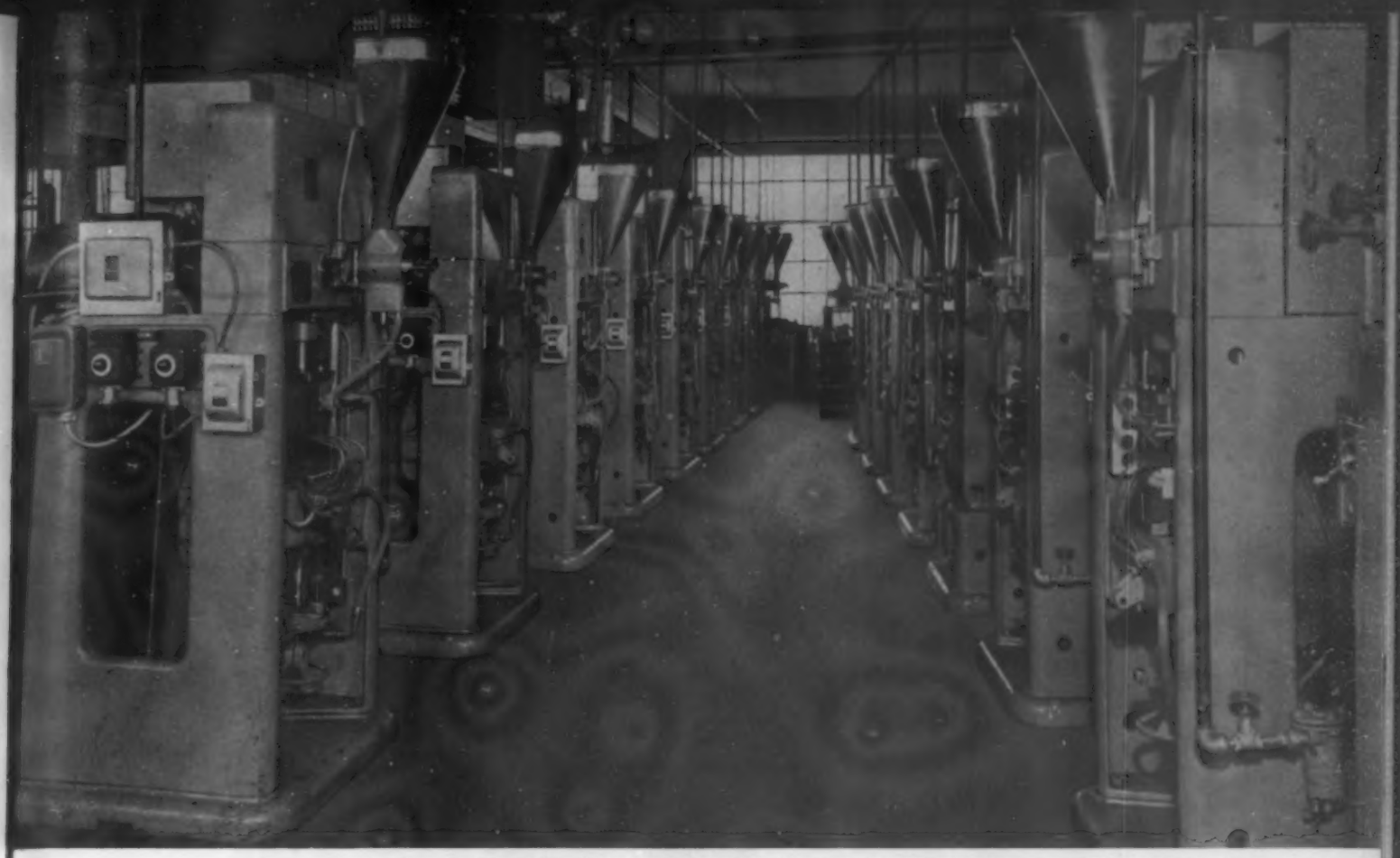
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Mold Automatically

TO MEET TODAY'S PROBLEMS

- **Automatic Molding enables you to get into production quickly, with molds having few cavities . . . molds that are made quickly, that cost less.**
- **You obtain higher daily output per cavity.**
- **You produce parts of highest quality and almost absolute uniformity . . . moldings that readily meet the most exacting government specifications.**

This installation of 19 Stokes presses is operated 24 hours a day, 7 days a week. *One skilled man tends the entire battery* . . . also changes molds, sets up and retimes machines, etc. There's no attendant on the night shift.

Output is a half-million or more parts per week, *with total rejects less than 3%,* despite the fact that parts are accepted by testing only one or two in each lot and if a single sub-standard molding is found the entire lot is condemned.

Automatic Molds, with one or few cavities only, are used. *These are quickly made and put into production.* They cost much less than large multiple-cavity molds, require less tool-steel, less toolmaker's time to make, less breaking-in.

Molding time is saved. Cycles are reduced 50% or more in some cases. Every split second is saved. Output is increased in proportion.

Molding material is saved . . . 8% to 10% or more. Every mold charge is accurately metered. There's very little flash, little finishing.

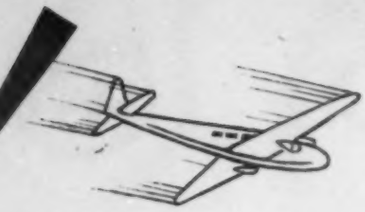
Automatic Molding fits perfectly into the defense picture . . . produces *economically* parts that meet the highest standards . . . saves rejects, time, labor, material, mold costs.

F. J. STOKES MACHINE COMPANY
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Representatives in New York, Chicago, Cincinnati, St. Louis, Cleveland, Detroit
Pacific Coast Representative: L. H. Butcher Company, Inc.

F.J.Stokes MOLDING EQUIPMENT

FJS Est. 1895

The Winning Panel!



HERE is the airplane instrument panel which won the Modern Plastics first award as announced in the November issue . . . entered by Glenn L. Martin Company . . . molded by The Formica Insulation Company, on Elmes presses.

Of course, many men and many factors played a part in developing this winner. However, the award indicates that Elmes presses are doing their share in producing winners. In fact Elmes presses are turning out "winners" wherever plastics are molded. Moreover, Elmes builds a great variety of hydraulic equipment, for example: Presses, Accumulators, Pumps, Accessories, etc.



MADE ON ELMES PRESSES





Write for New Catalog

Write today for a copy of the new catalog pictorial, a generously illustrated presentation of hydraulic equipment and machinery. When writing, mention the type of equipment which interests you most.

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Also Manufactured in Canada
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ELMES



Resinox

ADDS A LUXURY NOTE TO THE DASHBOARD . . .

Smooth and lustrous, with all the rich color and grain pattern of a fine cabinetworker's masterpiece—that's a quick description of this automobile radio grille molded of Resinox, Monsanto's phenol-formaldehyde molding compound, by Bay Manufacturing Division, Electric Auto-Lite Company.

Designed as an integral part of the dashboard, to simulate beautifully grained mahogany, it adds a new note of luxury to one of the most beautifully styled, popular-priced cars.

But that's just half the story.

Here, as in nearly all the jobs for which Resinox is enlisted, important production economies were achieved at the same time new beauty and style were added. The grille emerges from the mold practically ready for installation with little finishing and no further assembly operations needed.

For more information on Resinox, its future possibilities in *your* products, and the names of competent molders, inquire: MONSANTO CHEMICAL COMPANY, Plastics Division, Springfield, Massachusetts. District Offices: New York, Chicago, Detroit, St. Louis, Birmingham, San Francisco, Los Angeles, Montreal.

THE FAMILY OF SIX MONSANTO PLASTICS

(Trade names designate Monsanto's exclusive formulations of these basic plastic materials)

LUSTRON (polystyrene) • OPALON (cast phenolic resin)
NITRON (cellulose nitrate) • FIBESTOS (cellulose acetate)
SAFLEX (vinyl acetal) • RESINOX (phenolic compounds)

Sheets • Rods • Tubes • Castings • Molding Compounds
Vuepak, Rigid Transparent Packaging Materials

MONSANTO PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND



For Today *And* Tomorrow

BIRDSBORO
HYDRAULIC PRESSES

Birdsboro Hydraulic Presses are capably meeting today's exacting production demands in America's rapidly growing plastics industry.

Along with doing today's jobs well, Birdsboro multiple platen sheet and general molding presses provide security for the future with flexibility and ease of control that will more than measure up to tomorrow's needs.

BUILDERS OF

Hydraulic Presses • Special Machinery
Crushing Machinery • Rolls
Steel Mill Equipment

BIRDSBORO
Hydraulic Presses

THE BIRDSBORO STEEL FOUNDRY AND MACHINE COMPANY • PLANTS AT BIRDSBORO AND READING, PA.



Christmas balls molded by Plax Corporation, Hartford, Conn. Taylor-Freeman-Stanley Inc., New York City, distributors.

Christmas in the Plastics Age . . .



This young lady of the Plastics Age is enjoying a thoroughly modern Christmas, with her almost unbreakable toys. They are excitingly colorful, but the color won't lick off, because it's built into the cellulose acetate plastic.

Countless gifts for grown-ups, too, are made of this modern material, which offers an exceptional combination of advantages for the fabricator, the seller, and the user.

ECONOMY: It is easy to mold on high-speed, automatic machines; intricate shapes can be extruded in continuous strips; there are practically no finishing costs, and all scrap can be reworked. Of especial importance now, this remarkable plastic is proving superior in the place of materials restricted by priorities.

SALES-APPEAL: There is an endless variety of beautiful colors, from soft pastels to brilliant hues, translucent or opaque, or sparkling, clear transparency. And cellulose acetate plastic is light in weight, pleasant to touch, has high dielectric strength, and resists certain destructive agents.

Hercules has made important contributions to the high quality and versatility of cellulose acetate. To get the benefit of these advantages in *your* finished plastics, ask your molder to use a compound made with Hercules Cellulose Acetate Flake. Write Dept.M-12 for literature.

HERCULES

CELLULOSE ACETATE

DDD-43

HERCULES POWDER COMPANY · WILMINGTON, DELAWARE

Incorporated

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FIRST CHOICE!

FOR INDUSTRIAL RESTAURANTS



IN the great plants which are being built to produce defense material from one end of the country to the other restaurants are necessary to feed the workers and a very high proportion of these restaurants are being equipped with Formica table tops—so many that a large percentage of Formica table top output is classified as for defense purposes.

Formica tops are not only beautiful—but they are clean, sanitary and practical. They stand up to hard wear; they do not spot or chip or crack. They are easy to clean. In short, they give many years of perfect service with a minimum of attention.

That is why the Army Medical Department uses them in its hospitals; why so many have been purchased for military camps—why in war, as in peace, Formica remains the No. 1 table top.

Let us send literature with color suggestions and construction details.

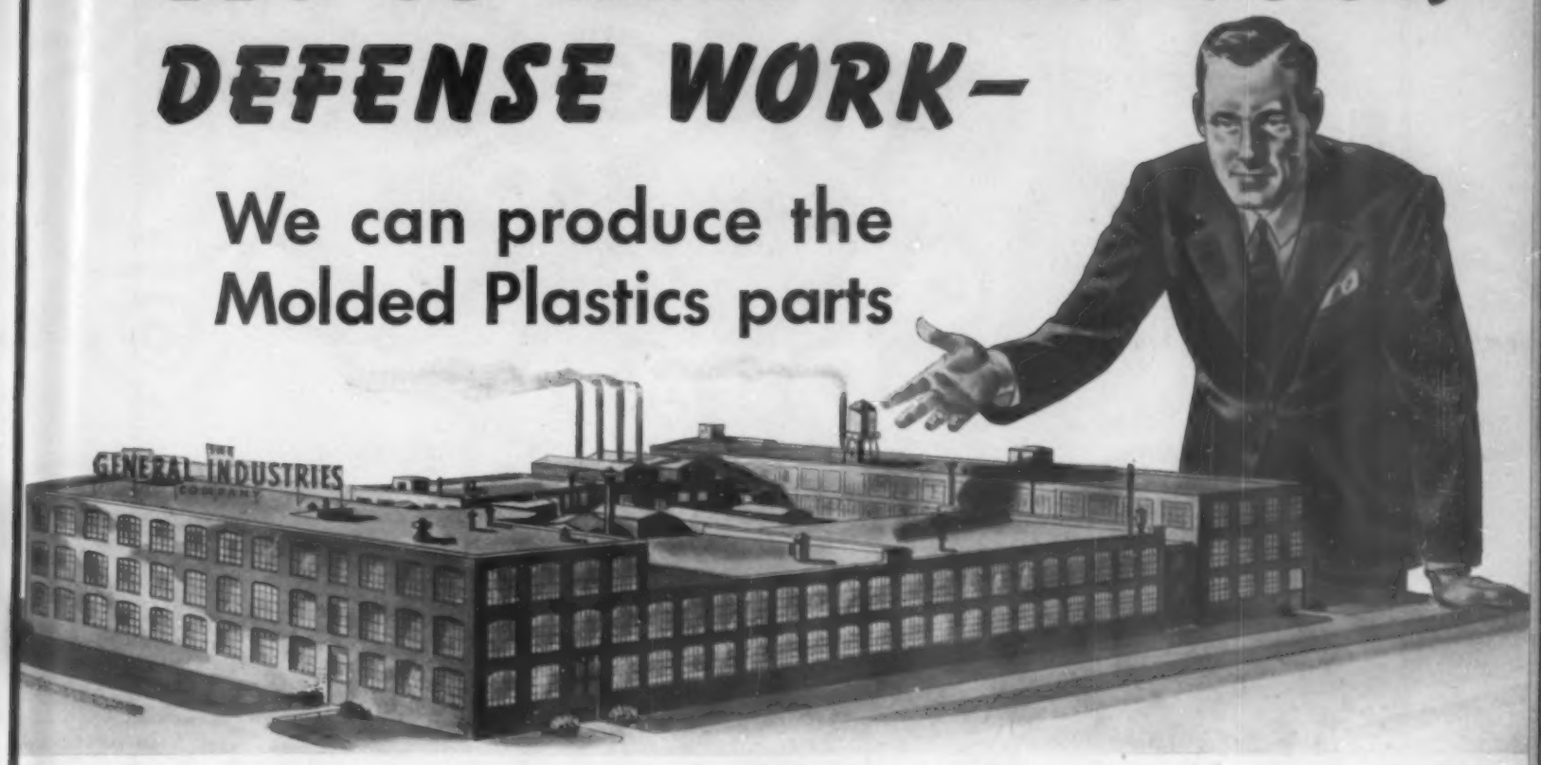
The Formica Insulation Co., 4658 Spring Grove Ave., Cincinnati, Ohio

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FOR FURNITURE AND FIXTURES

LET US HELP WITH YOUR DEFENSE WORK—

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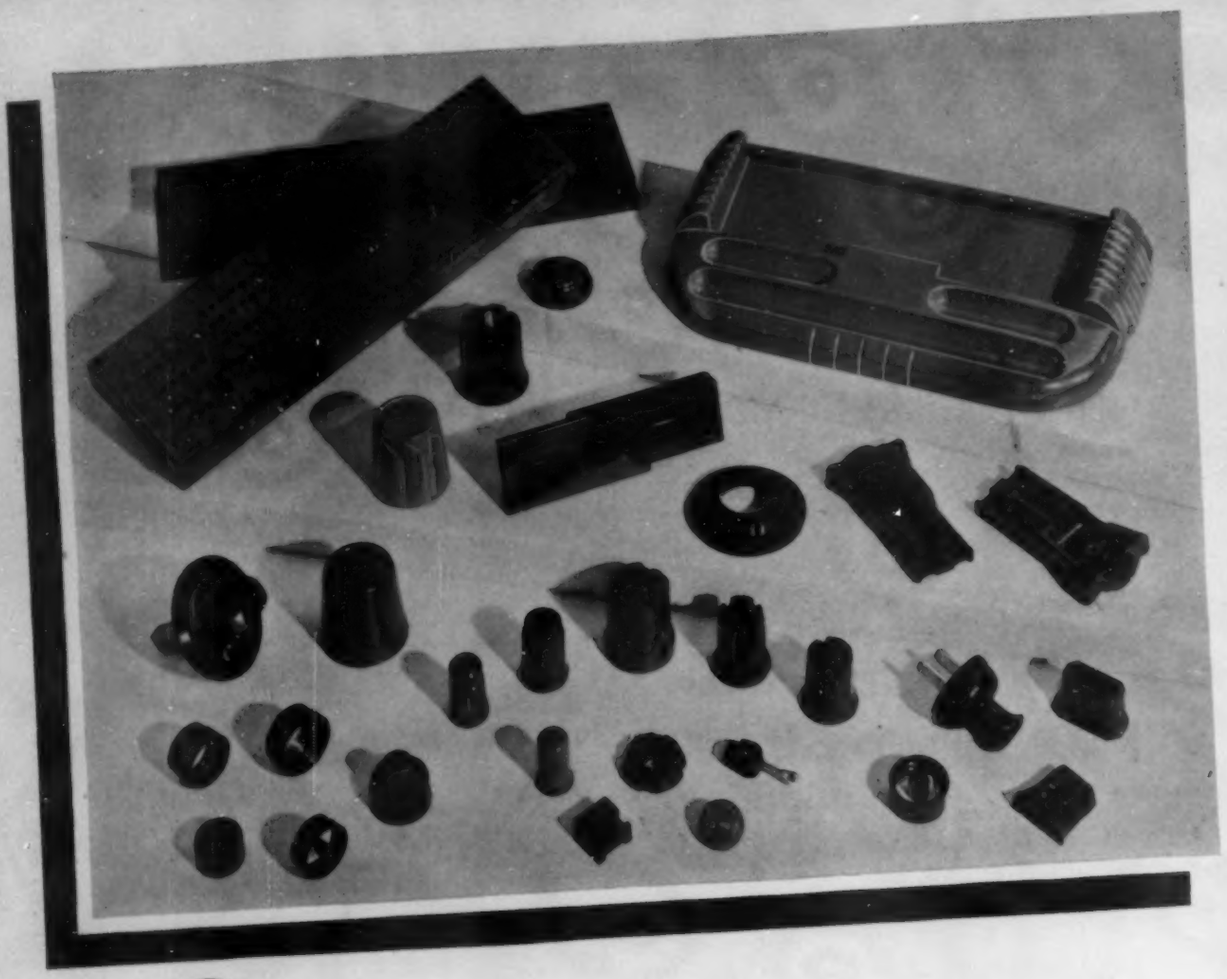
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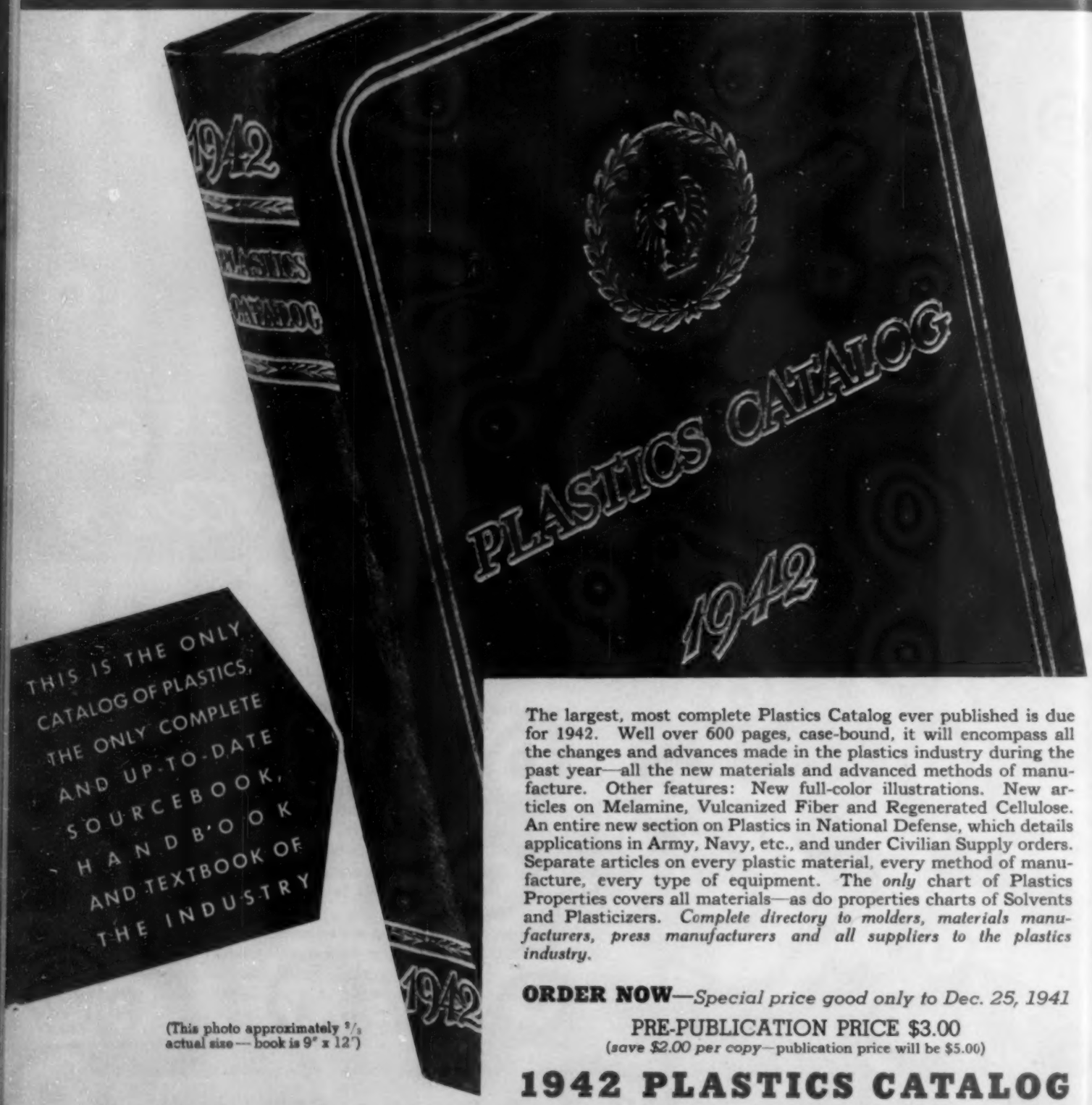
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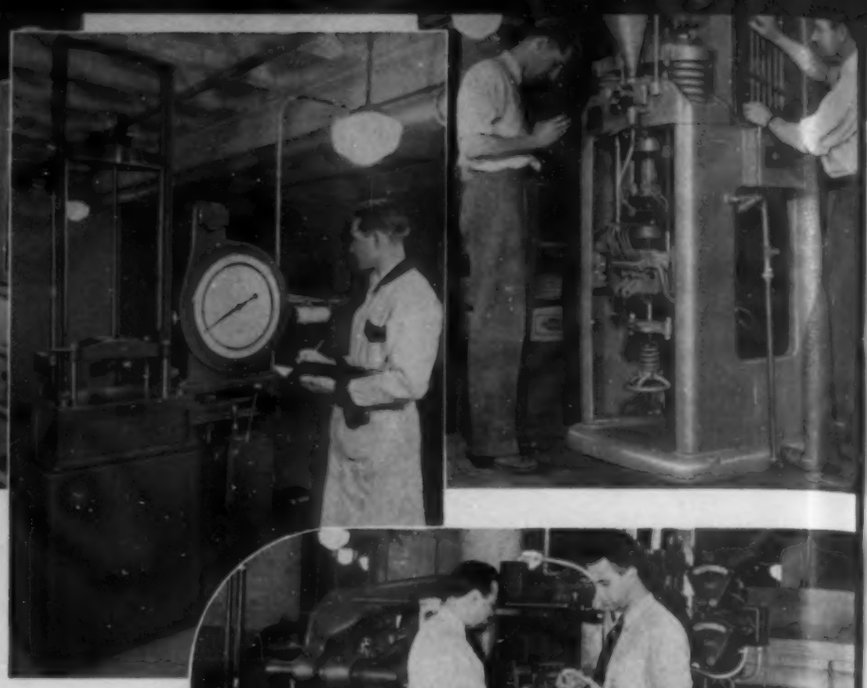
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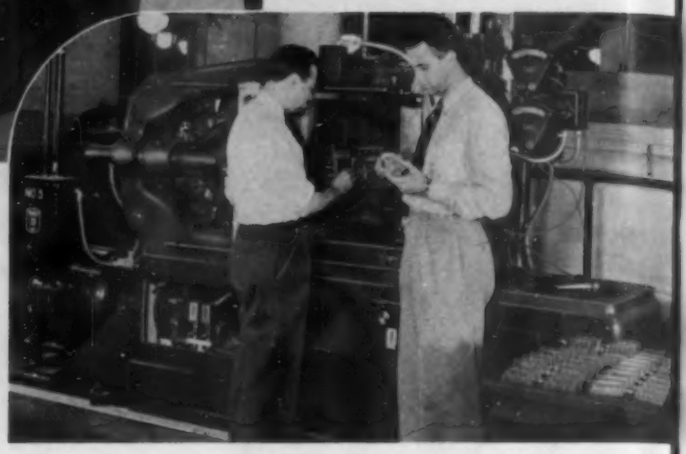
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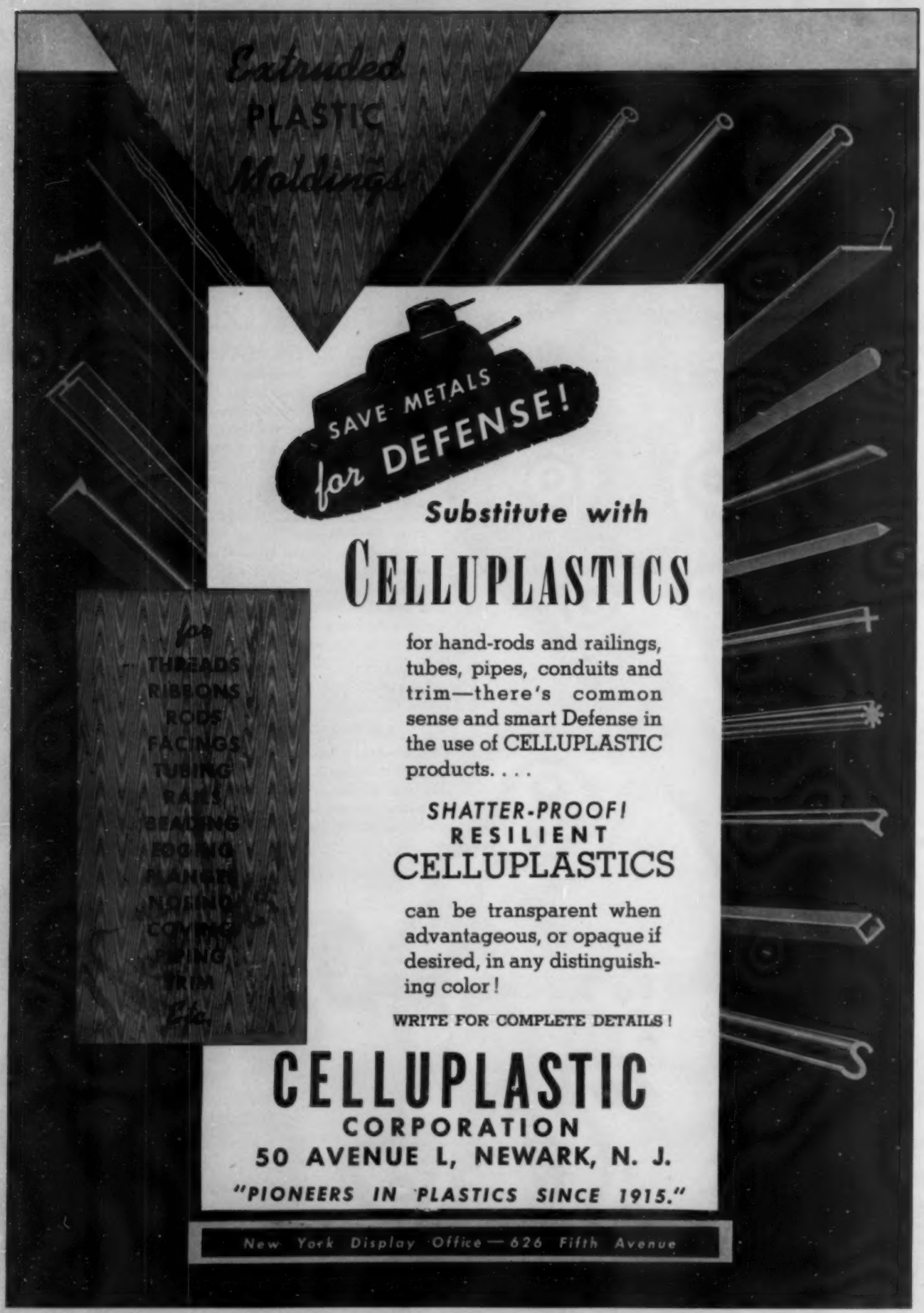
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MODERN PLASTICS
DECEMBER 1941 VOLUME 19 NUMBER 4

New architectural beauty for floors

DUE to the shortage of metals the beauty, durability and color possibilities of plastics have come to the attention of architects today for blocking of sections of terrazzo, a marble and cement composition commonly used for flooring in large buildings.

Extruded strips of cellulose acetate butyrate attached to ribbons of galvanized iron are used as an outline of the design to be followed in laying terrazzo floors. The plastic strip remains visible after the terrazzo has been ground and polished. The strips localize minor cracks which occur when terrazzo floors settle or contract in hardening. Instead of appearing as an irregular split, the cracks tend to run evenly along the strips.

Terrazzo strips had heretofore been made in metal. The shortage of zinc and brass drew the attention of designers and architects to the possibilities of plastics. They found the material not only excellent as a substitute, but also useful for experimental purposes in turning out a variety of designs and colors, which heretofore could not be attempted.

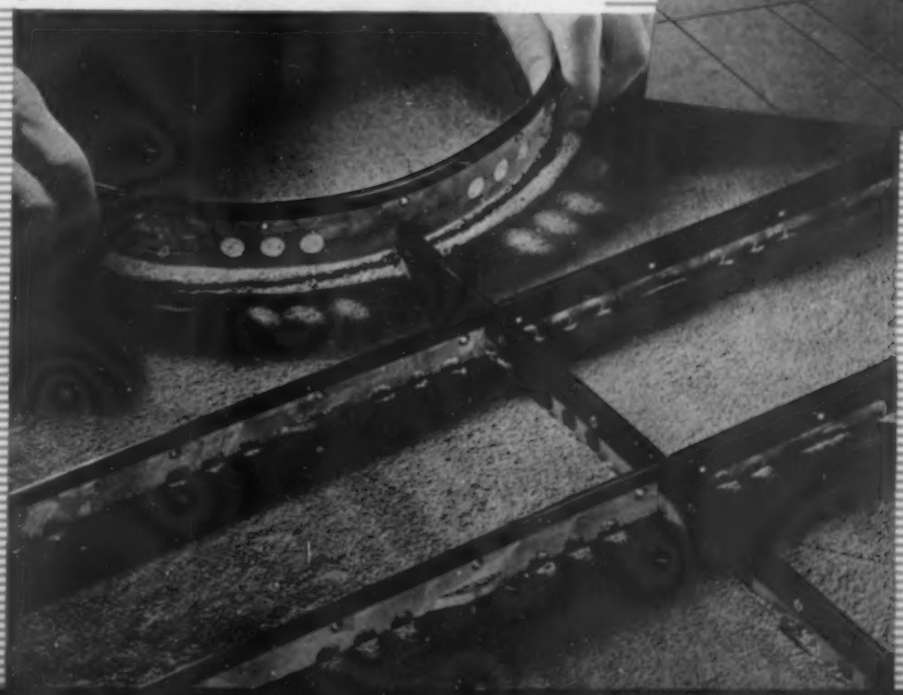
Tests were conducted to determine merits of plastics for this application. The Rockwell hardness test, a measure of toughness, showed that the plastic strip was comparable to one of brass. Also, an important

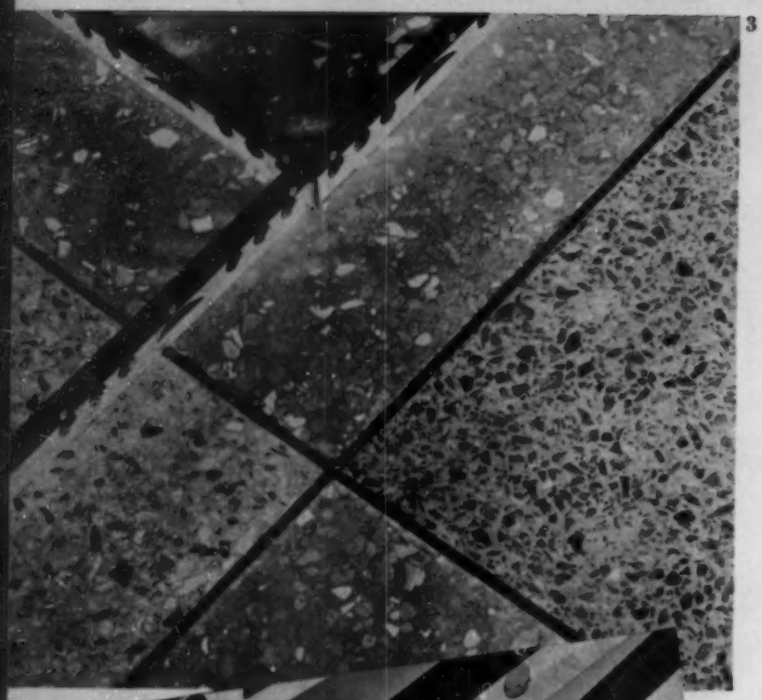
1—Lobby of an apartment building showing the simplicity and beauty of a terrazzo floor. 2—Plastic strips being placed prior to laying the floor. Flexibility of the strip, indicated by piece in the background, enables the architect to plan intricate designs

1

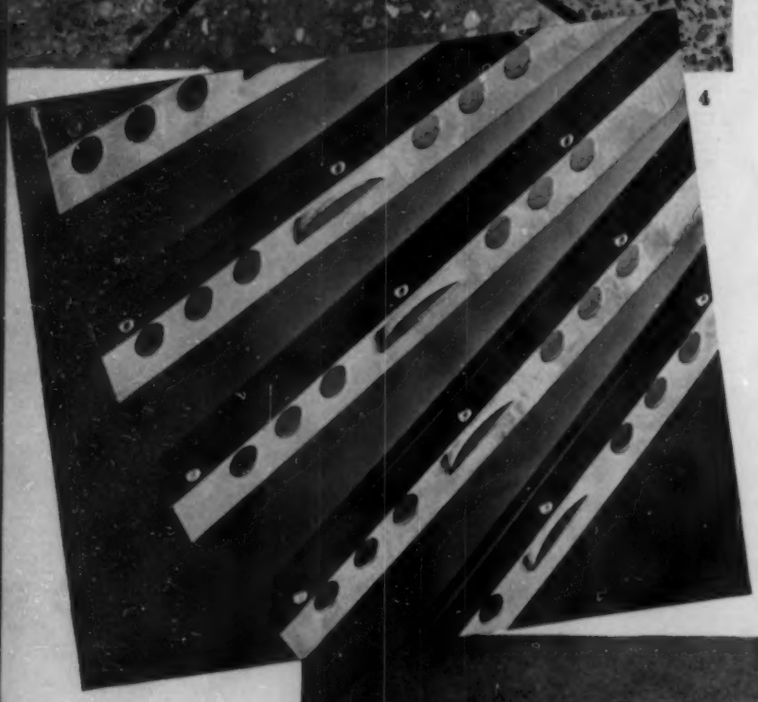


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4

point, the plastic could be set in exactly the same way as metal, ground in the same manner, and could be shaped in any form because it is not brittle.

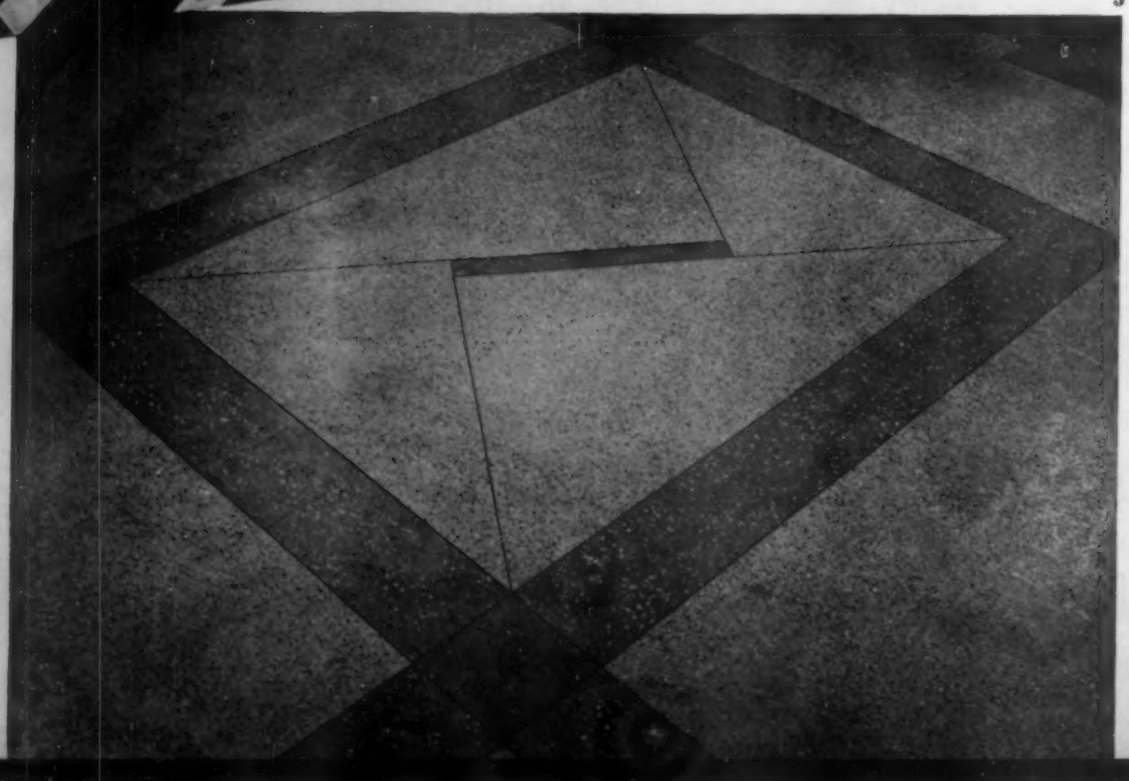
Heretofore, in laying the terrazzo, metal was not prominent in the finished job. Because of the color and decorative value of the plastic, however, it is now made part of the design. At present only white with a dark floor and black with a light floor are manufactured, although other colors are being considered.

Moisture does not affect the strips to an appreciable degree, nor is the material hazardous in the presence of fire. In one test, it is claimed, a welding flame of approximately 3000 deg. F. was placed directly on the plastic inlaid in the floor. The material melted, but it did not catch fire.

The plastic is molded by the extrusion method, which forces heated material from a mold much in the manner that toothpaste is squeezed from a tube. Small rivets are used to fasten the plastic strips to the iron base. The plastic part that shows in the finished floor is five thirty-seconds of an inch wide, and the assembled piece is one and one-fourth inches deep. The top part of the strip is all plastic and the bottom galvanized iron, that will not rust. Strips can be bent and rolled to any desired shape. This attribute, coupled with the deep, rich color, makes an effective floor for lobbies of apartment houses, hotels, office buildings, solariums and some homes. Terrazzo is used in stores, restaurants, swimming pools, partitions and for wainscoting.

Credits: Tenile II strips, extruded by Extruded Plastics, Inc., for the Manhattan Terrazzo Brass Strip Co., Incorporated

3—Strips of plastic in the background showing the iron base have been placed on the floor to illustrate the construction of the piece. In foreground one can see the black strips flush with the flooring, a finished installation. 4—Terrazzo inserts showing iron base and plastic strips. 5—A particularly fine example of a terrazzo floor



5



Durable thermoplastic housings improve telephone equipment

Injection molded telephone handsets

by R. M. SPONG*

THE telephone, symbol of 20th Century speed and ease of communication, always at the business man's elbow, has had a long and varied history in the use of plastic housings. Now, with the pinch of national defense, plastics production and research on telephone equipment have been speeded.

In the development of the modern telephone set, and indeed, of the vast network of communications of which it is the most common representative, plastic materials have played a considerable part. That they are destined to play an even greater part in the industry is witnessed by the fact that after some years of research, engineering, tests and trial production, Western Electric, the service of supply for the Bell System, is now devoting a certain percentage of telephone set housings production to thermoplastic injection-molding.

Millions of handsets have already been molded from phenol plastics, production in that line dating from about 1927. For some time fabricated laminated plastics has served in the electrical mechanism of telephones. On many telephones the round transparent disks which protect the station call number have been stamped from clear sheet plastic.

Although large quantities of mica-shellac and other thermoplastics have been used in manufacture by the company for nearly 50 years, the use of molded thermoplastics in the telephone instrument or plant has heretofore been limited to a few small injection-molded parts. They were mainly terminal blocks and switchboard indicator sleeves.

On the other hand, Western Electric and the Bell System have long maintained a program of industrial thrift, conservation of strategic materials, and research for economic and efficient substitutes for materials that are vital to telephone construction. As early as 1925, a group of materials engineers in Bell Telephone Laboratories were assigned to this specific field. And now, in the light of the defense emergency, officials and engineers of Western Electric, Bell Laboratories and the American Telephone and Telegraph Company confer regularly on materials matters.

Several years ago, engineers began to work with thermoplastic compositions for the housings of the combined telephone set. For experimental purposes, dies constructed for die-casting metal telephone bases were converted for injection-molding plastics, and then run in injection presses of adequate capacity. Various materials were molded—both the cellulosic and the non-cellulosic types.

Many considerations entered into the picture before the design and the plastic (*Please turn to page 94*)

* Information Dept., Western Electric Company.

Advice to the molder

by L. T. BARNETTE

IT HAS come increasingly to our attention that molders want to know how to procure defense work. We receive inquiries daily on this all-important question. Although it is true that there are no hard and fast rules, it is possible to set down some suggestions and answer the more important questions.

First, let us define the terms. Government contracts are divided into two classes: (1) Direct, represented by items that are purchased and used by governmental agencies; (2) Sub-contracts for items purchased by prime or sub-contractors. It is interesting to note that in a display of plastic parts assembled at Washington, over 90 percent were sub-contract, leaving only 10 percent for direct contracts. Therefore, the best chances, by 9 to 1, lie in selling to sub-contractors, and this is feasible on a most economical basis.

As we all know, there is an actual shortage of plastic materials for general purposes. Manufacturers have tried to anticipate demands and provide an ample supply for important applications. Production programs of this type, due to the expanding defense schedules, lease lend demands, etc., have been seriously interrupted and, in some cases, completely halted. Fortunately, there still seems to be enough plastics for vital defense production.

Every molder, naturally, wants to have a share in using this available material, and if he will plan his campaign intelligently, there should be no reason why he should not play a part in the defense program. The following facts and suggestions for procedure are outlined for consideration by the molders.

Direct contracts

If you are in search of a direct contract, presenting plastics facilities to the various governmental departments will not help in the defense emergency. These divisions are so busy with routine work that they do not have time to analyze manufacturing or fabricating facilities and translate them into actual production requirements. On the other hand, if molders want to work out items which are purchased direct, it is advisable to find out what parts the various services are using and plan to use. The next step is to see if you can find a suitable material and develop a plastic design which will meet all of their service requirement specifications. Present your suggestions after your research has been completed. If the product of your conception appears practicable you may be able to secure a development order. At this point it is well to carefully consider design specifications so that any liberties you may want to take in the design will be satisfactory for the application involved.

When a complete drawing to actual scale is presented to a Government engineering department for approval, it may bring out a need for further functioning changes in design which will be helpful in manufacturing or finishing. Be sure to obtain definite approval of your own drawing! If there is still any question, however, it is often wise to make some samples by hand for further consideration before going ahead with the tools.

A development order usually contemplates a single cavity experimental mold for the production of approximately 100 parts for limited field and laboratory tests. This may require from 60 days to 6 months, depending upon the amount of mold work involved as well as unanticipated difficulties in molding. These preliminary tests will determine whether or not the materials used are suitable and the design is satisfactory for the particular application involved. Very often it is necessary to try out several different materials and also make minor revisions in design before the parts are suitable for actual production consideration.

When, and if, everything appears to be satisfactory and preliminary tests meet the service requirements, a further development order will be issued to produce 1000 or 2000 more parts either from the experimental single cavity or from a production mold. By this we mean that very often satisfactory parts are secured from an experimental single cavity die, whereas a multiple cavity production mold does not yield comparable parts. If there is any likelihood of such a variation in results, a production mold should be constructed for the larger quantities necessary for field tests. The larger quantities thus produced will then be utilized for unlimited field tests under the varying climatic conditions prevailing in Panama, Alaska, western deserts and seaboard arsenals.

Depending upon the circumstances and the application involved, such a procedure requires from 6 months to a year. Although many parts have been approved more rapidly, it is necessary to plan on at least a year to 18 months, or even longer, before direct experimental work results in production. In following out such a direct development program, costs must be anticipated in the educational and sample parts ordered because when it comes to a production bid, the procurement officers are legally bound to place the business with the lowest bidder. Under these circumstances it will not be possible to include experimental or laboratory costs and still remain in competition with others who will estimate from the blueprint specifications accompanying the request for bids. Of course, the firm that carries the development through to the actual production basis will have the advantage of knowing the exact cost, since they have made the experimental and field test samples. In many instances, this unfortunately has proved to be detrimental because other firms eager for defense business may gamble on their estimates and thereby become the low bidders.

Regardless of the most rigid (*Continued on page 96*)

The plastics industry and defense

THE defense production effort brings new responsibilities and new difficulties to every business in the U. S., including the plastics industry. Originally, we planned to superimpose the defense program on the regular routine of business but, due to our tremendously increased production schedules, we are now endeavoring to fit at least some of our regular business in with the defense program.

OPM is issuing orders for more strict control of plastic raw materials and related products. Orders covering cotton linters, cellophane (see page 84), phenols and methanol (presented in full below) were issued early in November; and simultaneously the Supply and Priorities Allocation Board and the OPM announced preparations for allocation of all critical industrial materials. Detailed information will be needed on the monthly requirements of critical materials for production of military, industrial and civilian items and essential public services, and for repair parts and capital expenditure.

This procedure will demand complete information from the plastics molding and fabricating industry if it is to secure proper recognition. Records of orders and production must be maintained and parts classified as for military, public service or civilian use. Inasmuch as military and public services are self-explanatory, a further detailed classification under industrial and civilian items should be made. For this purpose the formaldehyde order* can be used, although in a strict sense it applies to the thermosetting type of plastics only. The industry must be prepared at all times to submit up-to-date data if the allocation of materials is to be equitably and practically executed.

The plastics industry is of such importance in the defense work and civil life of the country that the war must be fought and won before any of us can even begin to think in terms of business as usual—although we can continue to dream about the applications we hope to develop when the war is over. The industry should emerge from this readjustment all the stronger for its experience and, its defense job successfully done, go ahead just that much faster.

MODERN PLASTICS, Sept. 1941, opposite p. 44.

TITLE 32—NATIONAL DEFENSE

CHAPTER IX—OFFICE OF PRODUCTION MANAGEMENT

Subchapter B—Priorities Division

PART 969—PHENOLS

AMENDMENT TO GENERAL PREFERENCE ORDER NO. M-27 TO CONSERVE THE SUPPLY AND DIRECT THE DISTRIBUTION OF PHENOLS

(a) Section 969.1 (General Preference Order No. M-27) is hereby amended to read as follows:

WHEREAS, the national defense requirements have created a shortage of Phenols, as hereinafter defined, for defense, for private account, and for export, and it is necessary, in the public interest and to promote the defense of the United States, to conserve the supply and direct the distribution thereof;

Now, therefore, it is hereby ordered that:

969.1 *General Preference Order*

(a) *Definitions.* For the purposes of this Order:

(1) "Phenols" means:
  (i) Synthetic phenols of all grades and from whatever source derived.
  (ii) The acids, either in pure or crude form, recovered from coal tar distillates or petroleum, comprising chiefly phenol, ortho cresol, meta cresol, para cresol and xylenols and various mixtures of these products.

(2) "Producer" means any person engaged in the production of Phenols and includes any person who has Phenols produced for him pursuant to toll agreement.

(3) "Distributor" means any person who has purchased or who purchases Phenols for purposes of resale.

(b) *Applicability of Priorities Regulation No. 1.* Control of the supply and direction of the distribution of Phenols is hereby taken by the Director of Priorities, and all future transactions of any kind in Phenols are regulated and governed by the provisions and definitions contained in Regulation No. 1 of the Priorities Division of the Office of Production Management, issued on the 27th day of August, 1941, except as herein otherwise specifically provided.

(c) *Assignment of Preference Rating to Certain Defense Orders.* Deliveries under all Defense Orders which have not been assigned a higher preference rating are hereby assigned a preference rating of A-10.

(d) *Restrictions on Deliveries.* On and after December 1, 1941, no deliveries of Phenols shall be made, or accepted by any person, except as specifically directed by the Director of Priorities. At the beginning of each calendar month the Director of Priorities will issue to all Producers and Distributors specific directions covering deliveries of Phenols which may be made by such Producers and Distributors during such month. Such directions will be made primarily to insure the satisfaction of all defense requirements and to provide an adequate supply for essential civilian uses, and they may be made at the discretion of the Director of Priorities without regard to any preference ratings assigned to particulr contracts or orders. If the Director of Priorities shall not have issued, by the first day of the month, specific directions covering deliveries of Phenols which may be made during such month, Producers and Distributors may, subject to the provisions of Priorities Regulation No. 1, make deliveries of Phenols without limitation.

(e) *Reports.* Reports required by Priorities Regulation No. 1, hereinabove referred to, shall be made at such times and on such forms as shall be prescribed therefor by the Chemicals Section of the Office of Production Management. In addition to the reports required by Priorities Regulation No. 1, every person other than a Producer having an inventory of Phenols in excess of a 30-day supply thereof shall forthwith report such fact to the Chemicals Section of the Office of Production Management. A 30-day supply of Phenols shall be a quantity equal to one-twelfth of such person's consumption (distribution, in the case of a Distributor) of such Phenols during the 12-month period ending September 30, 1941.

(f) *Effective Date.* This Order shall take effect immediately, and unless sooner terminated by direction of the Director of Priorities, will expire on the 31st day of July, 1942.

(P.D. Reg. 1, Aug. 27, 1941, 6 F.R. 4489; O.P.M. Reg. 3 Amended, Sept. 2, 1941, 6 F.R. 4865; E.O. 8629, Jan. 7, 1941, 6 F.R. 191; E.O. 8875, Aug. 28 ,1941, 6 F.R. 4483; sec. 2(a), Public No. 671, 76th Congress, Third Session, as amended by Public No. 89, 77th Congress, First Session; sec. 9, Public No. 783, 76th Congress, Third Session)

Issued this 10th day of November, 1941.

DONALD M. NELSON,
Director of Priorities

CHAPTER IX—OFFICE OF PRODUCTION MANAGEMENT

Subchapter B—Priorities Divison

PART 971—ALCOHOL

AMENDMENT TO GENERAL PREFERENCE ORDER NO. M-31 TO CONSERVE THE SUPPLY AND DIRECT THE DISTRIBUTION OF METHYL ALCOHOL (METHANOL)

(a) Section 971.1 (General Preference Order No. M-31) is hereby amended to read as follows:

WHEREAS, the national defense requirements have created a shortage of Methyl Alcohol (Methanol) for defense, for private account, and for export, and it is necessary, in the public interest and to promote the defense of the United States, to conserve the supply and direct the distribution thereof;

Now, therefore, it is hereby ordered that:

971.1 *General Preference Order.*

(a) *Definitions.* For the purpose of this Order:

(1) "Methyl Alcohol" (Methanol), known also as wood alcohol, means Methyl Alcohol in any form and from whatever source derived.

(2) "Natural Origin Methyl Alcohol" means Methyl Alcohol produced by the destructive distillation of wood.

(3) "Synthetic Methyl Alcohol" means Methyl Alcohol manufactured by any process other than by the destructive distillation of wood.

(4) "Producer" means any person engaged in the production of Methyl Alcohol and includes any person who has Methyl Alcohol produced for him pursuant to toll agreement.

(5) "Distributor" means any person who has purchased or who purchases Methyl Alcohol for purposes of resale.

(b) *Applicability of Priorities Regulation No. 1.* Control of the supply and direction of the distribution of Methyl Alcohol is hereby taken by the Director of Priorities, and all future transactions of any kind in Methyl Alcohol are regulated and governed by the provisions and definitions contained in Regulation No. 1 of the Priorities Division of the Office of Production Management, issued on the 27th day of August, 1941, except as herein otherwise specifically provided.

(c) *Assignment of Preference Rating to Certain Defense Orders.* Deliveries under all Defense Orders which have not been assigned a higher preference rating are hereby assigned a preference rating of A-10.

(d) *Directions with Respect to Residual Supply.* After providing for all deliveries under Defense Orders, giving preference among such deliveries in accordance with any preference ratings specifically assigned thereto, Producers and Distributors shall make deliveries of Methyl Alcohol in accordance with the following directions:

(1) Deliveries of Natural Origin Methyl Alcohol to persons who require the same for use as a denaturant for ethyl alcohol and who, prior to delivery thereof, shall have certified to the Producer or the Distributor (a) that the Natural Origin Methyl Alcohol sought will be used (sold, in the case of a Distributor) for such use only, and (b) that the quantity sought in any month, together with all quantities on order with other Producers or Distributors for delivery during such month, does not exceed one-twelfth of the quantity of Natural Origin Methyl Alcohol used by such persons for such purpose during the 12-month period ended September 30, 1941, are hereby assigned preference rating B-4.

(2) Deliveries of Synthetic Methyl Alcohol to persons who require the same for general chemical manufacture including the production of formaldehyde for non-defense uses permitted in General Preference Order No. M-25 as amended, and excluding the uses set forth in paragraph (d)(3) hereof, and who, prior to delivery thereof, shall have certified to the Producer or the Distributor (a) that the Synthetic Methyl Alcohol sought will be used (sold, in the case of a Distributor) for such purpose only, and (b) that the quantity sought in any month, together with all quantities on order with other Producers or Distributors for delivery during such month, does not exceed one-twelfth of the quantity of Synthetic Methyl Alcohol used by such persons for such purpose during the 12-month period ended September 30, 1941, are hereby assigned preference rating B-4.

(3) Deliveries of Methyl Alcohol to persons who require the same for anti-freeze or general denaturant and solvent uses, and who, prior to delivery thereof, shall have certified to the Producer or the Distributor (a) that the Methyl Alcohol sought will be used (sold, in the case of a Distributor) for such purposes only, and (b) that the quantities sought, in any month, together with all quantities on order with other Producers or Distributors for delivery during such month, does not exceed one-twelfth of the quantity of Methyl Alcohol used by such persons for such purposes during the 12-month period ended September 30, 1941, are hereby assigned preference rating B-3.

(4) When a non-defense order for Methyl Alcohol for a use specified in paragraph (d)(1) and (2) hereof, to which a preference rating has been assigned either by specific certificate or otherwise, is offered to a Producer or a Distributor, it shall be accepted, subject to the same terms and conditions applicable to the acceptance of Defense Orders set forth in Priorities Regulation No. 1; and deliveries shall be made under such an order in accordance with the preference rating assigned thereto and the delivery schedule specified therein even though deferment of deliveries under non-defense orders, bearing a lower preference rating or no preference rating, previously accepted is necessitated thereby. Any person seeking to place a non-defense order to which a preference rating has been assigned must make application for acceptance of such order in the first instance to his regular supplier (if a person has several regular suppliers, the order should be divided among such suppliers in accordance with such person's normal method of placing orders).

(e) *Reports.* Reports required by Priorities Regulation No. 1, hereinabove referred to, shall be made at such times and on such forms as shall be prescribed therefor by the Chemicals Section of the Office of Production Management.

(f) *Inventory Restrictions.* Anything in this Order to the contrary notwithstanding, in addition to the inventory restrictions contained in Priorities Regulation No. 1, hereinabove referred to, no person shall accept deliveries of Methyl Alcohol which will effect an increase (or a further increase) in such person's inventory of Methyl Alcohol in excess of a 30-day supply, at the expected rate of use (distribution, in the case of a Distributor) thereof.

(g) *Effective Date.* This Order shall take effect immediately and unless sooner terminated by direction of the Director of Priorities will expire on the 31st day of July, 1942.

(P.D. Reg. 1, Aug. 27, 1941, 6 F.R. 4489; O.P.M. Reg. 3 Amended, Sept. 2, 1941, 6 F.R. 4865; E.O. 8629, Jan. 7, 1941, 6 F.R. 191; E.O. 8875, Aug. 28, 1941, 6 F.R. 4483; sec. 2(a), Public No. 671, 76th Congress, Third Session, as amended by Public No. 89, 77th Congress, First Session; sec. 9, Public No. 783, 76th Congress, Third Session.)

Issued this 12th day of November, 1941.

DONALD M. NELSON,
Director of Priorities

MODERN PLASTICS will continue to keep its readers informed on all Government orders affecting the plastics industry; and will, from time to time, present news items relative to plastics in defense which it believes will be of interest to all concerned with the production and use of plastic materials. Such news items will be found on page 84 of this issue.



Here is a good example of the surface wiring sections set unobtrusively along the dinette partition. The molded phenolic sections are painted white. Three outlets are being used. Other sections may be added along the baseboard so that the housewife can cook conveniently

Sectional surface wiring system

WHEN low cost housing was being studied by the John B. Pierce Foundation, research brought to light the fact that the use of electric energy would play an important part in providing comforts and conveniences for low income groups. Therefore, electric wiring became a major item in the research and development conducted by the Foundation.

This system of electric wiring won a top Award in the Sixth Annual Modern Plastics Competition. Due to space limitations of the November issue in which awards were reported, complete details of the research and development of this system could not be fully discussed. Therefore this expanded article was prepared.

After nine years of experimentation by the John B. Pierce Foundation, the Pierceway Sectional Plastic Wiring System was perfected. It is a safe, economical system of surface wiring, and can be installed without defacing walls or creating unnecessary mess. The system is extensively used in low cost electrified homes and in prefabricated houses erected for the Government in defense areas. It permits an extension from an existing outlet. This design is an economical means of providing the final link of the electrical distribution system to the numerous places where electrical lighting fixtures, lamps, office machinery and other equipment are used. The user may add to the sectional system without much expense or trouble. The amount of surface extension of the wiring system is determined by the immediate requirements of the room and the uses planned.

The sections are made of molded phenolics in a dark brown shade which will blend unobtrusively into any room or office, or may be painted any color. They consist of a Feed Section, Outlet Section and Male and Female end caps. The Feed Section is 16 in. long by $1^{7}/_{16}$ in. high. Across the face there is a device which can be easily unscrewed to get at the electrical circuit to make a connection. The back of the molded plastic strip has a standard connection for armored cable or any insulated wire. The Outlet Section is of the same dimensions. There are two openings here where the current may be reached by a plug. Openings are about 8 inches apart. It can be readily seen from the photographs that as many outlets as needed can be obtained by attaching any number of outlet sections to the feed section. The Female and Male caps are purely for the sake of finishing the end of the run.

The Pierceway Sectional Plastic Wiring runs along the baseboard of home or office for any distance, depending on the number of Outlet Sections attached to the Feed Sections.

According to the manufacturer of this modern electrical wiring device, 99 percent of existing and supposedly up-to-date office buildings are electrically obsolete, and little has been done (*Please turn to page 90*)



1—Completed prefabricated house, a product of the assembly line. With the use of synthetic resin-bonded plywood as a basic building material, houses of this type are turned out rapidly—complete even to window units.

Houses off the assembly line

Skillful use of synthetic resin-bonded plywood and synthetic resin adhesives for prefabricated houses

WHILE scientific dreams of all-plastic furniture and plastic houses are still nursed in the laboratory, structural prefabrication on a commercial scale has actually been accomplished by the use of comparatively insignificant amounts of the self-same plastic resins in adhesive form.

Using synthetic resin-bonded plywood as a basic building material, modern prefabricators have been shipping virtual houses off assembly lines to building sites all over the United States with the same promptness and dispatch as the automobile manufacturer with his product. Defense housing projects by the score have mushroomed under this speedy discharge of prefabricated house parts.

One manufacturer has gone a few steps further in the use of synthetic resin adhesives for structural prefabrication. Taking Douglas fir plywood panels 8 ft. by 4 ft., with the grain of face plies running across the 4-ft. dimension, this company has developed a system of resin bonding these panels together by a special type of joint into a composite wallboard 8 ft. wide in lengths up to the maximum shipping size of 20 feet. These resin-bonded joints develop 75 percent to 80 percent of the strength of the plywood and make possible a continuous wall covering of practically any length.

Although available as bare board for both interior and exterior purposes, this giant board is manufactured for interior use with 64 by 64 thread count unbleached muslin bonded with synthetic resin adhesive to its surface. Here again plastic resins make a new development possible. This cloth covered wallboard provides a permanently check-free surface for decoration and takes the place of one coat of paint.

Although a very small percentage of synthetic resin is used in the manufacture of this board—actually only about 5 percent by weight—without their development, and that of other glues having plastic properties, prefabrication would still be in the experimental stage.

It takes about 35 lbs. of dry thermosetting resin per 1000 sq. ft. of veneer to bond the plywood and another $2\frac{1}{2}$ lbs. per 1000 sq. ft. to glue the panels together into a continuous wallboard. About 30 lbs. of resin per 1000 sq. ft. attach the cotton cloth.

The manufacturing process begins with the making of the joints which lock the 3-ply $\frac{5}{16}$-ft. panels into continuous lengths. These jointed panels pass into an

automatic narrow-line electric hot press where they are "welded" together permanently by the use of synthetic resin adhesive. The joints are cooled by a refrigeration unit and then smoothed down under sanders.

The 8-ft. wide continuous panel passes next under power sprays which cover the face with another type of resin adhesive, onto which is affixed the cotton textile fabric, fed automatically onto the face from large bolts overhead. A battery of infrared lamps in the next operation dries the glued cloth. This phase is omitted, of course, for such panels as are not to be fabric covered.

The final operation of this assembly line is the "cut-off" where automatic saws quickly and accurately cut the board into room wall lengths as required. This eliminates all joint making on the actual job of erecting the house. Up to this point the material is in the form of one continuous board over 100 ft. long and 8 ft. wide. The assembly line is capable of producing 60,000 sq. ft. of fabric-covered board per 8-hour shift. At the present time practically this entire capacity is allotted to defense housing work.

Defense work involves the prefabrication of plywood faced "stressed cover" double wall units where the large wall panels, exterior and interior, are welded permanently with resin adhesive to the studs and framing members in a large, specially designed hot press. In this case, the resin bonds the entire contacting surface of the studs thus displacing nails and producing a union of enormously greater area so that the resistance of the wall to deformation is correspondingly increased. A resin or glue bonded joint is tremendously stronger than a nailed joint. In this manner exterior and interior face panels become part of the load-carrying factor in the wall. This permits thinner walls with lighter weight studding and, at the same time, produces a wall of strength and rigidity far superior to the usual conventional construction.

Door and window units, with their proper frames, are similarly fabricated. All pieces are properly tagged at delivery thus avoiding confusion at the building site.

The company has just completed the prefabrication of walls for 150 duplex buildings—300 5-room housing units—at Manette, near Bremerton, Washington, for a U.S.H.A. Defense Housing project.

Here all vertical parts of the houses were erected with an average of 24 man-hours for each duplex unit—in other words, the equivalent of 12 man-hours for a 5-room dwelling. All interior walls were of fabric-covered special board and all exterior surfaces without the fabric covering. This system proved least satisfactory.

The completed house, as one can see from the illustration on the opposite page, is snug and compact. It would fit beautifully into any model suburb in any model town in the United States. Architecturally, its lines are simple and dignified. The garage is part of the house—just a step from the kitchen. Devotees of Functionalism could find no fault with this unit because it is so simple, yet so complete. The unusually large windows allow the tenant to get the full benefit of the sun. Those who have lived in these prefabricated houses claim that they do not get tired of all the rooms on one floor, such as the one shown here, because the interior is attractively broken up and there is enough room to experiment with partitions.

Credits: Resin-bonded walls manufactured by The Speedwall Co. Resins by I. F. Laucks, Incorporated

2—Factory photo of the board production line. Board is cut into room wall lengths as required. This eliminates all joint making on the actual job of erecting the house





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Textiles from casein protein fiber

FASHION writers may soon inform their startled feminine readers of bargains in perfectly divine Guernsey-cow prints and Holstein jackets of unmistakable chic, judging from the latest news on use of a by-product of skim milk, technically known as a protein fiber of the prolon family.

One of the largest dairy companies in the country has just finished four years of experimentation and announced their findings on the new fiber. It will be available for dress fabrics in the spring and also for permanent waving to replace cloth strips with which hair is wound before heating and waving. Felt hats of this casein base are already on the market.

Fibers were subjected to exhaustive tests including resiliency, tensile strength, abrasion, odor, affinity to dyes and ability to withstand dry cleaning and washing. It is claimed that the fiber can be readily blended with wool, mohair, cotton, rayon or fur in varying proportions. It is said to give distinctive characteristics to fabrics in which it is used, and is less expensive than rayon and cotton; less costly than fur and wool. Claims made for it, that would endear any fabric to a dress manufacturer, are that it supplies drape and substance which previously could be obtained only through the use of fur and wool in some fabrics. Furthermore, it produces unusual effects when blended with rayon.

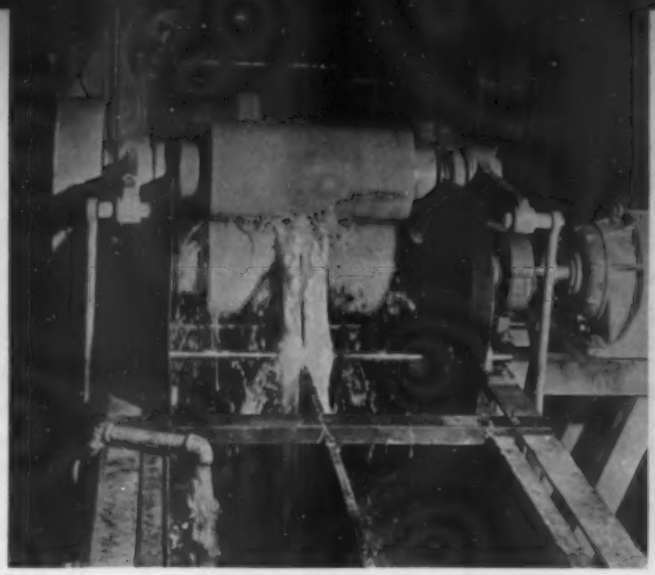
The fashion story is only part of this interesting new discovery. The significant fact is that billions of pounds of skim milk now used as feed for live stock, for want of some better use, can be converted into a new and potent industry. The skim milk is the residue after milk is converted to butter, cream or one of the many other dairy products.

Processing of fiber from milk is not new, for as far

5



1—In this spinneret, the honey-like viscous casein is converted into fiber. It contains holes through which the material is forced under high pressure. Although the fiber appears to be a solid mass, it is actually thousands of different strands. 2—Strands are contained in the four "tapes." Hand, at right, indicates translucency and relative size. 3—This photograph shows one of several washing processes in making protein fiber. The fiber is run into tanks and squeezed through rollers. 4—Fiber going through one of many chemical baths it receives during processing. Note size of the bath vats contrasted with the smallness of the fiber "tow" being treated. 5—This machine cuts long skeins of the fiber into desired lengths. 6—In this apparatus, resembling a huge washing machine, the fiber is squeezed, under tremendous centrifugal pressure, free of chemicals which are recovered for reuse. The fiber then goes through another washing process. 7—Finally, the finished fluffy material is ready to be pressed into 450-lb. bales and shipped all over U. S. and Canada. Production capacity at present is 5,000,000 lbs. annually



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back as the latter part of the last century scientists were experimenting with casein fiber. It was not until this new process was perfected, however, that a milk-derived fiber was wholly acceptable to the American textile industry.

Investigation of the possibility of producing a high-grade fiber from casein was begun in 1937. As one of the world's largest processors and distributors of dairy products, the company was concerned over the vast amount of skim milk for which apparently there was no commercial outlet. Although increasing amounts of casein were used in paper-coating, plastics, paint and in other industries, yet about 80 percent of the nation's skim milk was without any commercial outlet.

A research laboratory, which was instrumental in the modern development of casein paste paint, was commissioned to experiment with casein fiber. A staff of scientists and technicians worked for months in the laboratory before they were ready for even experimental manufacture. They investigated all previous attempts to make satisfactory fiber out of casein and finally succeeded in overcoming what in the past had appeared to be insurmountable obstacles.

After four years of experimentation, the fiber is now marketed with a production capacity at present of 5,000,000 lbs. annually. The promise that this new business holds is best illustrated by the fact that the factory at this early stage is operating on a 24-hour basis and has been for four months.

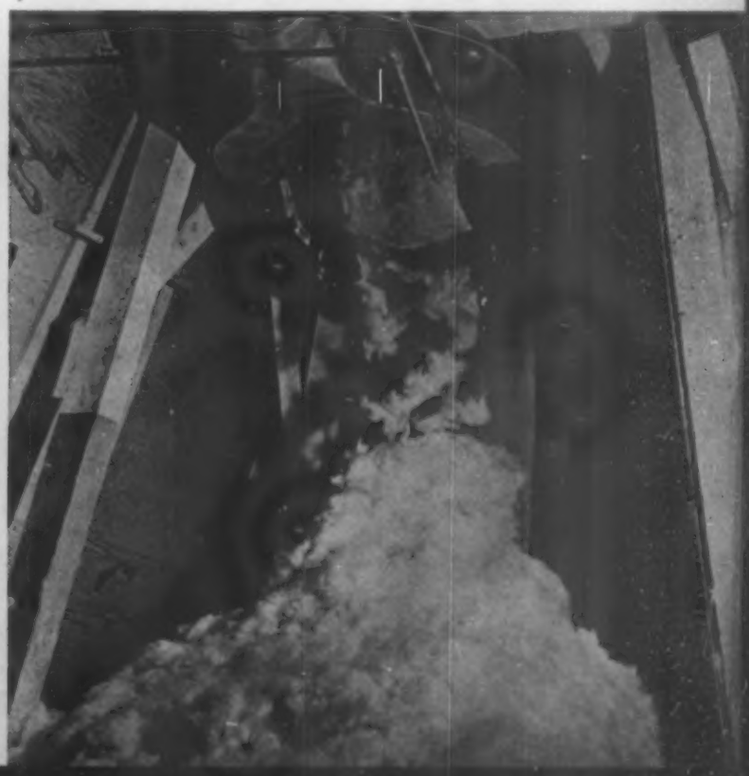
Textile mills also had been experimenting with the fiber, but several processing changes were necessary before desirable blending qualities with other fibers were achieved. While the fiber was basically the same as for hats, certain adjustments had to be made in the finishing. After the processing for textiles had been perfected, the casein product was found to possess certain characteristics which, in some instances, resulted in decided fabric improvement.

Casein constitutes about 3 percent of skim milk. After being extracted from milk, dried and ground, it is treated with chemicals and heated into a viscous, honey-like form. Forced (*Please turn to page 88*)

6



7





Fluorescent tube coils

Thin strands of cellulose acetate wound into tight, spring-like coils and slipped over fluorescent tubes do a double duty. They remove objectional glare and add to the decorative values of the room. The diffusers are produced by winding thin, transparent and translucent strands of the plastic into tight springy coils. Because the material is available in an unlimited color range, all types of color combinations are possible, ranging from pastels to vivid primary colors. The coils are said to be virtually indestructible and will outlast many lamps. Although the size and wattage of fluorescent tubes may be changed in order to vary the amount of light available, the brightness of any single tube once installed is constant. Since the plastic is manufactured in forms ranging from a clear transparency to opacity, the amount of light shed by a tube sheathed in cellulose acetate depends upon the translucency of the coil. Red and clear strands wound together have been found to be best for white and daylight fluorescent light, both of which are deficient in red rays. Pink coils serve as diffusers and aid in correcting color distortion. Coils are made by the extrusion process. Plastic is forced from the die, cooled and allowed to harden.

Credits: Material, Tenile. Manufacturer of Plasticoils, Schwab and Frank, Inc. Extruder, Detroit Macoid Corporation

PRODUCT DEVELOPMENT

Loop antenna housing

For years the manufacturers of radio compass equipment for aircraft have been faced with the problem of obtaining a suitable streamlined housing for enclosing loop antenna. The rigid requirements of such a housing were met by a designer who had perfected his special technique in Czechoslovakia. The requirements of the housing were light weight, resistance to abrasion normally encountered on fast aircraft and impact due to rough handling; waterproofness, ability to withstand a wide range of temperature, humidity and pressure variations encountered in modern military aircraft. Similar material meeting all these requirements had been used for several years for stage settings, window display and many decorative objects. The basis of the product is cellulose acetate flake mixed with various plasticizers and other ingredients. The material can be made as soft and pliable as silk or as hard as a rock. Furthermore, it can be applied either on the top or inside of the mold, and is always made in one piece. This increases the strength of the housing and eliminates any possibility of leaks through the joints. This comparatively new method of producing large or small articles in plastics without expensive molds and large presses has been accepted very enthusiastically by many of the foremost interior designers. Another important point is that weight is said to be half that of any other housing on the market. Laboratory tests and service on many commercial planes have demonstrated the ability of the material to meet all requirements set down by the air service. Housings are now reported to be in use on Army and Navy bombers, and on commercial airplanes.



Credits: Material, Marolin. Manufacturer and designer, Czecho Peasant Art Co., Inc., for Kearfott Engineering Co., Incorporated

Compacts and cigaret cases



Christmas will indeed be gay for the lucky girl who receives this sterling silver compact or cigaret case with translucent embossed plastic tops. They are available in the simple fawn or forest motif shown here. Plastic covers are of vinyl sheet stock in a grade selected to catch light. The thickness used is .070 inch. Method of fabricating the covers is interesting: A sheet of the desired thickness is chosen and proper circular or rectangular designs are cut out by press or saw blade, depending on the thickness of the material. A two-piece embossing die is then made which incorporates the design to be embossed in the upper section and has a groove for the lower section which holds the cut out designs in place. The die is then highly polished and chromium plated to insure a perfectly smooth finish on the plastic. Proper heating units are inserted in the press to maintain temperature of softening. The cut-out designs are inserted in the die and the design is embossed onto the sheet under heat pressure in a toggle-type compression press. After the embossed sheet is removed from the press it receives further finishing treatment. By means of belt sanding, barrel tumbling with wooden pegs or application of plastic buffing composition to the polishing wheel, the desired luster or dull finish is obtained. The frosted effect achieved in the vinyl sheet is due mainly to the color and luminescence of the pigment plus the subsequent polishing operations used.

Qualities of the material—toughness and resistance to water and chemicals—are fine for this novel application.

Credits: Material, Vinylite. Designed and manufactured by S. Buchsbaum and Company

PRODUCT DEVELOPMENT

Auto radiator hydrometer



Freez-D-Tector is a self-calculating freeze tester which indicates the cooling capacity of all popular makes of cars and shows the amount of full strength anti-freeze (in quarts) to add to the radiator solution for definite freeze protection. Three individual thermometers and correction tables insure absolute accuracy. The operator need only read the float and the table because the instrument does everything else. Molded cellulose acetate butyrate parts protect the float and glass jar against breakage and keep them free of oil, acid, grease and dirt. The instrument has a metal float housing, scientifically designed and precision engineered to offer maximum performance. The three individual thermometers are cushioned in rubber, each functioning as a separate unit. Special molded trusses and a rubber base protect the instrument from shock. For clear reading an 8-in. jar of glass tubing is used. A double diameter float with blown beads produces the equivalent in accuracy of two individual floats. Finally, an oversize bulb of 6 oz. is used to insure rapid tests and draw solution into the tester with greater ease. The instrument is equipped with a built-in flash light to illuminate the table for convenient night reading.

Credits: Material, Tenite II. Molder, Chicago Molded Products Corp. for E. Edelmann and Company



Transparent carved trim

Ancient designs from Asia Minor and streamlined modern motifs come to life in the hands of craftsmen skilled in wood-working. The company formerly dealt exclusively with the finer woods. Today, it has added plastics to its line of 3000 designs. It was found that 50 percent of their designs were practical to execute in plastics. Methyl methacrylate was chosen as the ideal material for carving. The same machines which had been used for woodworking are used for plastics with only minor adjustments. The tools, of course, are not the same, although no additional outlay of money for expensive tools or dies was necessary. Plastic designs are just as faithful to tradition as those done in wood. Among their stock items are the intricate motifs of the Gothic Period, as well as fine, delicate carvings of the Louis XIV and XV periods. Radio manufacturers, lamp manufacturers and hand-bag designers have also used these plastic carvings in ancient and modern designs. Lengths of acrylics are formed and bent to the required shapes. The peculiar edge lighting qualities of the plastic add to the decorative quality of the designs and enhance their loveliness

Credits: Material, Pleziglas. Fabricator and manufacturer, Klise Manufacturing Co., Incorporated

PRODUCT DEVELOPMENT



Electric fence controller

The necessity of seeking another material to replace aluminum resulted in unsuspected benefits to the manufacturer of an electric fence controller by his choice of acrylics. The unit, which controls the current fed into electrically charged fences, was housed until recently in a cast aluminum case. When the shortage of strategic metals made itself felt, the manufacturer experimented with various materials to replace aluminum and finally chose acrylics—primarily because of their excellent weathering qualities. It was found that transparent plastic sheets could be drawn to the proper contours when heated. Previously, the housing weighed more than 3½ lbs. and was expensive to produce. It also required extra plastic and porcelain parts to insulate the control from the housing proper. Today, the company is producing plastic housings for considerably less. Units weigh only 12 oz. and are formed in molds costing only a small fraction of the molds required for cast aluminum. A better looking water-and-corrosion resistant surface is automatically obtained by enamelling the transparent housing on the inside. The smooth exterior will not collect dirt as readily as the ribbed aluminum housing. The surface is glossier, and will retain its luster for years.

Credits: Material, Pleziglas. Fabricator and manufacturer, W. Haddon Judson Company

Insecticide spray



The first major improvement in a spraying machine to kill insects is encased in a plastic housing. Rightly called "The Killer" by its manufacturer, this insecticide spray fulfills the requirements of such a device. All the design features are achieved in the molding, and the assembly is simplified by the use of plastics. Finishing costs are also extremely low, and the instrument is lightweight and easy to clean. The unit is molded in two pieces. The top, which screws on to the unit holding the spray, is molded of urea, the bottom from phenolic resins. Wise choice of this combination of molding powders has resulted in a product unaffected by heat, water, steam and the chemicals in the spray itself. No strenuous effort is required to work the spray. Slight pressure of the thumb controls and regulates the volume necessary. The machine will spray a distance of from one to fifteen feet. It requires no adjustments or lubrication. Majority of sales will be to offices, schools, hospitals, dairy farms and institutions of all types, although the insecticide will also have some sales for home use. It is expected that the striking red and black color combination, permanent in finish, will tend to improve sales.

Credits: Material: Plaskon cover, Durez base. Manufacturer: Gibbs Manufacturing Co. for the Electro Spray Corp. Dies for lower part of case, Remler Co., Limited

PRODUCT DEVELOPMENT

Dehydrator housing

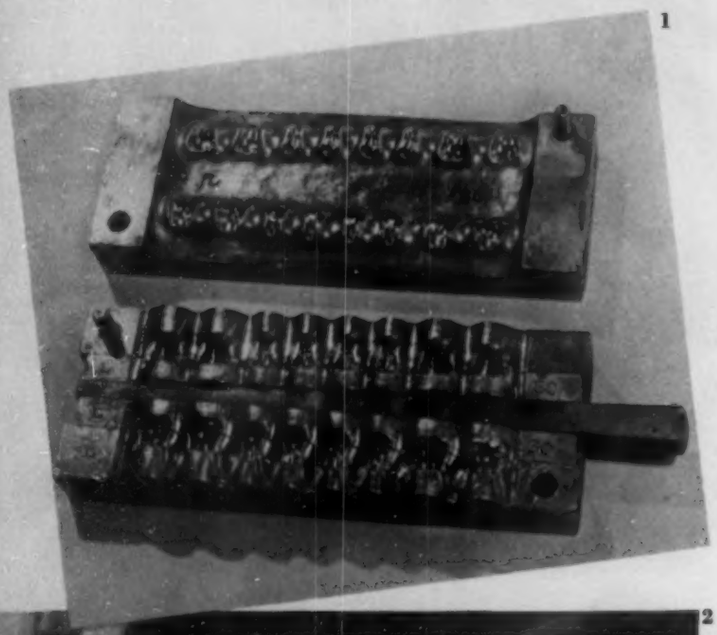


A molded cellulose acetate housing for a Bendix dehydrator has provided a tough and resilient unit which is impervious to temperature and humidity changes. The instrument is used in aircraft to prevent entrance of moisture into the streamlined housing of the loop antenna which is used with an automatic radio direction finding equipment. The housing is treated and sealed so as to be nearly airtight. A hose connection between the housing and the dehydrator unit permits air to breathe freely in and out of the housing as the aircraft flies at different altitudes and air pressures. The dehydrator excludes the moisture from this breathing air. Without the aid of such an ingenious device, moisture would enter the housing during the breathing process and become condensed because of temperature changes and the water thus collected would damage the delicate apparatus in it. The dehydrator has a transparent cellulose acetate cylinder and black cellulose acetate ends. The plastic was chosen after considerable experimentation because of its qualities of toughness and resiliency as well as mechanical strength and resistance to temperature changes. Production economies in molding are added advantages.

Credits: Material, Lumarith. Molder, Multiproducts Tool Co., for Bendix Radio Corporation

Mass production of plastic teeth

by HENRY M. JUSTI, JR.*



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COUNTLESS Americans who wear artificial dentures are today obtaining greater comfort and security because of the application of plastics to artificial teeth than they did during the years when teeth and dentures were made only of porcelain.

This statement is made advisedly by one who represents the third generation of a company that has specialized in the manufacture of porcelain teeth since 1864. It is not a condemnation of artificial teeth made of porcelain. Porcelain teeth have served the dental profession well, and until the recent advent of plastic teeth they were the best and only artificial teeth available.

In referring to plastic teeth throughout this article, we are speaking of teeth as separate units, distinguished from the pink denture base that supports the artificial teeth on the gums or ridges. The patient's first and outstanding reaction to plastic teeth is the mouth comfort made possible by the tough, yet resilient, qualities of acrylics.

The wearing qualities of plastic teeth in the mouth are similar to the wearing qualities of natural teeth. There is none of the jarring sensation of two flint-like surfaces striking together, as with porcelain teeth. It is a well-known fact in the dental profession that porcelain teeth will wear down and destroy the surfaces of natural teeth if they are opposed to them. It has been observed that they will also wear right through a gold inlay, or similar restoration.

It is true that heat induced by friction (such as caused by vigorously rubbing a plastic tooth on a piece of cardboard or soft wood) will soften and wear down the incisal or occusal (biting and chewing) surfaces of plastic teeth, but this condition would never exist in the mouth. Saliva as a lubricant is always present,

* President, H. D. Justi and Son, Inc.



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and masticated food acts as a "buffer" between the teeth in the act of chewing. A further evidence of comfort is in the contact of the mucous membranes (the lips, tongue and cheek) against the surfaces of plastic teeth.

A distinct advantage of plastic teeth is the feeling of security in the knowledge that if they should drop in the washbasin, or on a tiled floor, they will not chip, crack or break. Another advantage is that plastic teeth will not clatter or click when one talks.

An article in the March issue of MODERN PLASTICS, "Complete Plastic Dentures" by Dr. E. Byron Kelly, describes the method by which a dentist produces so-called "custom made" acrylic teeth. This is done by taking the impression of the patient's natural teeth before extraction, pouring a model in this impression, and then making a mold in which are packed both the tooth shaded acrylic and the gum shaded acrylic.

The present subject deals with the mass production methods employed by one manufacturer to enable a greater number of people to enjoy the benefits of plastic teeth at a price within the reach of most.

The accompanying photographs illustrate a small part of the equipment required, and show a few of the molds from which countless shapes and sizes of teeth are produced in a variety of shades.

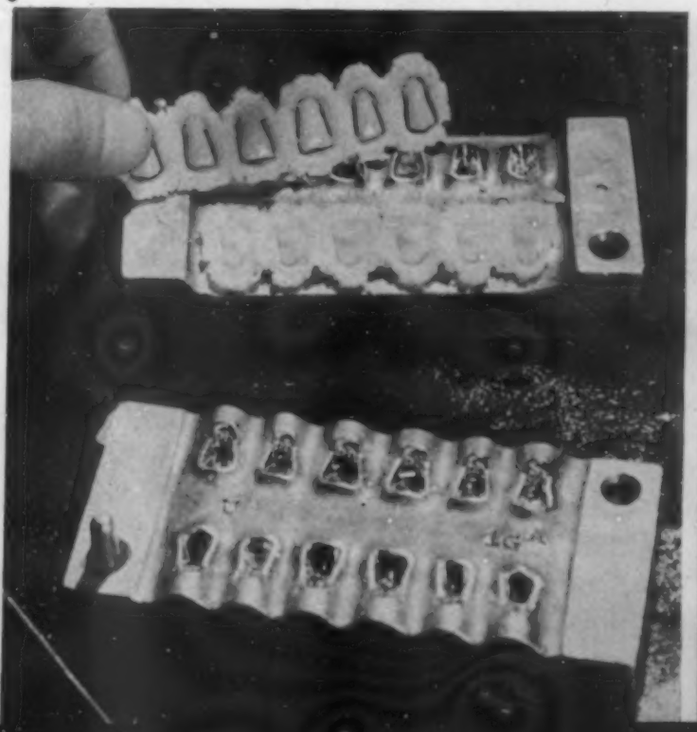
The first problem encountered in making the teeth was that of obtaining sufficient hardness in the acrylic powder. A balanced formula was required for this as well as the elimination of certain plasticizers and lubricants commonly used in commercial molding powders. Particle size of the polymeric methyl-methacrylate also became a prime factor. Once the balanced formula was found, pigmenting became a routine matter. Natural teeth have varying degrees of opacity and translucency which affect the surface brilliancy. All human teeth contain certain qualities represented by the following colors—white, yellow, grey, and dark red-brown. The selection of oxides for pigmenting necessitated considerable research in this field. The oxides used all come from the earth, and are as permanent as the earth. The creation of molds in which the artificial teeth are formed is a science that has been greatly improved since the early days of tooth manufacturing. Briefly, it can be summed up as follows:

(Please turn to page 88)

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1—Mold for artificial teeth. 2—The operator is packing the molds with powder. Proper blend from neck of tooth to incisal tip is the objective. 3—Molds loaded and packed with dry powder. 4—Mold is closed in an electrically heated oven. 5—After the mold is cooled, molded teeth and flash are removed. 6—The operator is shown removing the flash. Teeth are then polished to a high luster. 7—Some sets ready to be assembled, reinspected and placed in their respective packages ready for shipment to the dental trade

Fan blades for cooling towers

PROBABLY the largest fan ever operated for industrial purposes, using non-metallic blades, has recently gone into service. It is built of new 4½ foot long plastic blades composed of 41 pieces, that weigh only 27 pounds. The fans are used for cooling towers where large quantities of cooled water are needed for power plants, oil refineries, air conditioning and industrial processing.

The fan blade was an Award winner in the Sixth Annual Modern Plastics Competition held last month. Due to space limitations, it was impossible to give the complete story of this unique product development in the November issue; hence it is presented at this time.

Phenolic materials were chosen for the blade because they completely fulfilled the requirements of low cost and efficient, economical operation. Due to their corrosion resistant properties they are extremely effective in this service. One of the chief problems encountered heretofore had been corrosion in localities where there was salt water. Metal fan blades had to be painted and baked protective finishes applied before placing in service. Another advantage that should result in increased efficiency is the smooth, accurate, molded surface of the blade. This results from the fact that the blades are made in a highly-finished, steel mold; one of the largest of its kind ever built.

The blades consist of a laminated structure molded to form a phenolic-resin-impregnated wood unaffected by salt water. Four of the blades are assembled in a molybdenum cast iron hub to make a fan 12-ft. in diameter. The lighter weight of plastic blades lessens the radial load on motor bearings and, therefore, eliminates the necessity for special or more costly bearings. Another important consideration is the reduced starting torque which permits simple across-the-line starting as contrasted with elaborate electrical devices. When the problem was put before the engineering department of the company which developed and manufactured the blade the first thought was that blades could be made by using a standard phenolic resin with heavy canvas base—the inner part of the blade to be filled with some relatively inert material. In order to make this type of blade, however, it would have been necessary to mold in a metal insert by which the blade would be securely fastened to the metal hub, and this was not advisable. The engineering department then considered laminated wood, bonded together with phenolic varnish.

An intensive study was made of the raw materials to determine, among other things, the best resin to be used, type of veneer most suitable, degree of dryness when ready to press (check by Squeeze-Out and Volatile Content) to insure the best bonding and no remaining excessive resin. A study was then made of pressed materials to determine the best method of impregnation (soaking, pressure or vacuum); (*Please turn to page 94*)

Installing one of the large fan blades which have so successfully solved corrosion problems. It is made of a lightweight, molded-laminated phenolic material. The plastic blades are 4 1/2 ft. long





Nitrocellulose produces accurate lightweight table tennis ball with fine molded seam in only seven working days

All-American bounce

by MARK PETERS*

OF the countless plastic articles manufactured in the United States yearly, the table tennis ball is one of the most interesting by virtue of the fact that it has been American made only since 1929, and with a scant 2 years' experimentation. The expert player requires a ball which is extremely accurate, a perfect sphere, exact in diameter and weight, and counterbalanced. These are requirements of the United States Table Tennis Association, who issue official specifications and give approval on balls produced within their own regulations.

The origin of table tennis is vague. The general opinion is that it was first conceived by some British officers who fashioned a lightweight ball with bound cotton and wooden bats as a substitute for Battle Dor and Shuttle Cock. With the advent of nitrocellulose, a crude ball was made and bats with a sanded surface came into use. This is what created the game as it is known today. As time went on, table tennis equipment was constantly improved upon until today we have a highly perfected table tennis ball in conjunction with a balanced bat, surfaced with pebbled rubber. This modern equipment has made the game very fast.

Research work on this project involved perfection of a material rigid enough to hold a sphere shape permanently and at the same time the formula had to be workable for the molding process. Another problem was making a fine molded seam with an accurate width. The control of the ball's weight and counterbalance required tools that would take care of the most infinitesimal variation in texture and thickness of the material while the ball was being manufactured.

A table tennis ball takes 7 working days to produce. This time is consumed from the day the raw material starts its way until it becomes a ball ready to be shipped. A micrometer is the rule during the manufacture, from the time that the (*Please turn to page 92*)

* General Sales Manager, Nixon Nitration Works.

Award winners shown in Washington



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WITH the accolade usually reserved for official openings, Washington welcomed the exhibition of award winners of the Sixth Annual Modern Plastics Competition at the Department of Commerce building on Nov. 19. The exhibit will be on view in the building lobby until January 1.

Representative Dow W. Harter of Ohio officially opened the Plastics show. Among those present at the opening were: F. Sterling Wilson, Chief of Inquiry and Defense of the Commercial Intelligence Unit, Department of Commerce; J. F. Corwin, Office of Price Administration; G. Holgren, Bureau of Industrial Conservation, Plastics Section; Morris Sanders, Consumers' Durable Goods section of OPM; L. T. Barnette, editor of MODERN PLASTICS magazine, and advisory counsel to OPM on plastics, and John Coe, Commissioner of Patents.

The exhibition is dramatically displayed and beautifully lighted so that Washington will get the full impact of the role plastics plays today in both civilian and defense life. It will be obvious to Washingtonians, as it was to New Yorkers, that the majority of awards went to industrial and defense applications. One of the most



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1—Left to right, Morris Sanders, Consumers' Durable Goods Section, OPM; F. Sterling Wilson, Chief of Inquiry and Defense, Commercial Intelligence Unit, Department of Commerce; J. F. Corwin, OPM; G. Holmgren, Bureau of Industrial Conservation, Plastics Section, and L. T. Barnette, editor, MODERN PLASTICS magazine. 2—John C. Coe, Commissioner of Patents, examines an acrylic cockpit. 3—A section of the exhibit showing architectural applications

interesting productions on exhibit is the plastic-bonded plywood nose section of an airplane now in use in England. It is used on the Canadian Avro Anson bomber manufactured by Bristol Aircraft Corp. The smooth, rivetless surface of the plane has already attracted the attention of the public. The more thoughtful of the group realized exactly how great an advance has been made by use of plastics to release metals which are vital for defense production.

Also in this group was one of the most important improvements in aircraft design, the large, transparent acrylic enclosures for nose section, observation hatch and gun turret of bombers manufactured by The Glenn L. Martin Company.

Other applications of plastics to defense and communications that are proving popular are shown by Bell Aircraft Corp., Bristol Aircraft Corp. and Technical Ply-Woods and scientific applications, such as the Surgical Window for treating bomb wounds, furnished by the Cochrane Physicians' Supplies, Inc. and now used in Britain. This device serves as a porthole through which surgeons may observe the progress of a bomb wound and obtain cultures for analysis without disturbing the dressing or changing the conditions under which the wound is being treated.

The Bell Aircraft Corp. supplies one of the most important shipments to Britain these days. It is the plastic radio mast stanchion. Washington youngsters learned that this plastic radio mast stanchion is installed on the fast, cannon-bearing Bell Airacobras.

(*Please turn to next page*)



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4—Textiles, woven of extruded strips of vinylidene chloride, a new field for plastics, are represented in bus, airplane and garden furniture seats. 5—Representative Dow W. Harter, Ohio, admires the trophy won by Dorothy Shorb (right), Miss Defense of 1941. Model (left) wears a plastic-treated garment. 6—A typical display case includes a variety of plastic articles ranging from lamp shades and evening bags to industrial parts as well as some 6th Annual Modern Plastics Competition Winners



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Technical Ply-Woods show a lightweight interior cabin paneling made of a fiber plywood combination laminated with phenolic resin adhesive, which has gained considerable favor in the aircraft field. It is being used for trans-Atlantic flying boats of the VS-44-A type built for the American Export Airlines by the Vought-Sikorsky Aircraft Company.

Housewives found the award winners on household applications fascinating. All those conveniences of refrigerators, vacuum cleaners, washing machines and the smaller, but none-the-less essential things about the house, were displayed for their examination. Among them was one of the largest injection molded pieces ever made in the United States—an evaporator frame for the new large model Philco refrigerator.

In addition to these award winners there are jewelry and novelties; sporting goods, games and toys; musical instruments; wearing apparel and any number of unusual and practical means of using plastics. Latest developments in the extruded plastics field were evident. Chief among these were the woven extruded strips for theater, bus and subway seats manufactured by Heywood-Wakefield Company. Although the extrusion process is not new, it had been neglected until this year when it once again sprung into popularity. The practicality and beauty of material achieved by this method have focussed all eyes upon it today.

In conjunction with the exhibit, "The Magic of Modern Plastics," a sound and full color movie, tells the story of the manufacture and application of plastics.

7—From Christmas tree to orange squeezer, this display of plastic articles at the Exhibit attracted much attention. 8—Models attired in clothes that are either plastic-treated or trimmed. Two (left) wear Defense fashions. 9—Section of Displays

Seven million dollar itch

by JOSEPH STIFTER*

Skin allergies yield to preventative and healing treatments; protective ointments relieve industrial dermatitis

THE concerted battle of men and machines for maximum production has brought with it an ever-increasing toll of industrial dermatitis and the problem of how to cope with it. Recent reports from the United States Health Service Department place the annual cost of industrial and occupational skin diseases at approximately $7,000,000. The plastics industry falls in this category. Its gigantic expansion program magnifies the condition at the present time.

Mild irritations, caused by the phenol content in the majority of materials of coal-tar origin, are most quickly noticed by individuals whose skin is hypersensitive. In some cases, the irritation disappears as the body makes certain readjustments. However, chronic irritation may soon cause disability and most serious consequences. Medical care is indicated in even the slightest complaint but the solution to the problem rests not in the therapy, but rather in prevention. Naturally any such allergies of the skin are not caused by the finished molded or cast plastic product but arise because of incompatibility to certain chemicals. Any resulting dermatic condition to sensitive skin surfaces is usually met by prompt action in most raw materials and molding or fabricating plants.

Progress has been made by means of improving the proper ventilation. This minimizes both the time of exposure and the concentration of the fumes which cause "the itch." In view of the high temperatures and pressures which prevail in the operation of a plastics plant, other hazards occur in the mixing, molding, buffing and abrasive operations. The high temperatures are particularly harmful because perspiration activates the phenol content of the powder. This results in irritations ranging from mild, inflammatory conditions of the skin to actual burns. Ordinary hygienic preparations, including frequent washing with medicinal soaps, offer insufficient or little protection against the hazard. Various antiseptic solutions have been somewhat helpful, but inadequate to effect a cure.

Where irritation of the skin is observed in industrial plants, it is often aggravated by the use of soap. This valuable substance can itself be a cause of dermatitis because of the presence of free alkali even in allegedly superfatted soaps. As a chemical compound soap is stable only around pH 11. At this point, alkaline solutions attack the skin, resulting in absorption of water and hydrolysis of the proteins. Although most of the irritating properties of soap are due to this alkalinity, the fatty acids of coconut oil, cottonseed oil, and other oils may produce a definite reaction. The real cause of the dermatitis may be determined by patch tests, with soap, and with all the ingredients of the plastic.

The logical conclusion to be drawn from extensive experience in this industry is that preventive measures must be taken to guard the worker's health. Investigations and extensive research along these lines have resulted in the widespread use of protective creams. It should be noted that there is variance in the bases and contents of creams now available. For example, if a cream contains lanolin or petrolatum, there is an excellent possibility that it will carry the irritant—either the powder or phenol—directly into the skin by means of partial absorption. Moreover, there is a tendency in vehicles with an oil base, to encourage the precipitation of solid materials which accumulate on the skin and plug up the hair follicles. This mechanical action, caused by the very nature of the oils themselves, is the primary objection to their use.

There are protective creams, however, which do contain neither lanolin nor petrolatum as a vehicle, and it is these products which have given rise to the popular mechano-chemical technique which acts to prevent industrial dermatitis in the plastic industry. Such liquids or creams form a harmless protective coating over the skin. They must be of sufficient viscosity to form a coating that is completely insoluble in all known coal-tar compounds. By arresting perspiration, they eliminate the possibility of any chemical reaction between resinous powders, phenol and other materials activated by water. Most of the creams or liquids offered commercially in this latter class claim no curative or therapeutic advantages. They are provided solely for prevention and protection against toxicity of certain chemicals characteristic of the industry.

Chief features of what has come to be known as the mechano-chemical technique are the ease with which particular creams, ointments or liquids are applied, the high degree of protection they offer and the neutrality maintained in face of repeated assault from various chemicals. The protective cream, paste or quick-drying liquid must in itself contain no irritant, or potential irritant of any kind. Constant use of the substance, containing even the most minute irritant, would in time result in a skin irritation and disease of its own origin. A case in point is the use of a plastic, soft substance, polymerized to sufficient degree to retain its own plasticity, yet retaining optimum applicability for the compounding of a protective material.

The current emphasis on the use of proper liquids and creams in the plastics industry indicates that such preparations have definitely earned a place in the production, as well as in the hygienic program, of the industry. Also, in view of the country's need of speedy production, it is wise to take every possible precaution.

* The Milburn Co.



PLASTICS IN REVIEW

1 Hammond Brass Works replaces brass with molded Textolite in valve handles for various mountings. Handles accommodate several shapes of inserts which are pressed in place after molding. Lettering and decorations are depressed in surface of the plastics part for easy visibility and low-cost production. Designed and molded by Plastics Dept., General Electric Company

2 Because wooden boxes had proved unsatisfactory and too expensive, change was made to plastics to house this micrometer. For the 8-piece set, it has several molded-in compartments. Cover and base are relatively thick to insure a sturdy, long-lived article. Parts are unaffected by oils, soaps, greases and temperature changes. Molded of Durez by American Molding Co. for International Tool Company

3 This acid bath container is fabricated of Technical Catalin in a heavy case-hardened form. It is a large tank, 2 ft. high and 1 ft. in diameter, used to hold an acid solu-









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tion employed in nylon manufacturing plants. The material is acid- and water-resistant

4 Handsome, lightweight luggage handles in two sizes, injection molded of Tenite, will support heavy loads and stand rough treatment without breaking or denting. Reinforcing ribs and 2 small metal inserts make handles strong enough to bear weight of 150 lbs. Smooth, lustrous surface will not become stained or soiled from constant handling. Their smart lines enhance the appearance of any luggage. Colors are black, brown, ivory and buckskin. Molded by Chicago Molded Products Corporation

5 The health inspector examines a soda glass through the Ruud grease film viewer. He looks through an illuminated Pike Flash-O-Lens especially adapted by the Ruud Co. for use by health authorities in determining "grease-film" present in fountain-washed glasses. Various municipalities have adopted the viewer to ensure that drinking glasses used by the public shall be clean and sanitary. Bakelite phenolic forms lightweight housing for a 5-power lens. Molded by Boonton Molding Company

6 Compact goggle frames for industrial use are injection molded over metal inserts. Frames are made in two sections and then fastened together with metal inserts. Large, lightweight, they are molded in a variety of colors, with black and white predominating for industrial use. Molded of Ethocel by R. P. Place Co. Assembled and distributed by Dockson Corporation

7 Vibro-tool is a lightweight instrument for hand engraving. The housing is composed of two hollow sections injection molded of Lumarith by Elmer E. Mills Corp. for Burgess Handicraft and Hobby Service. Smooth and pleasant to touch, the housing is designed to fit comfortably into the hand in a writing position. Ball at the end is close enough to the top to permit ease of manipulation

8 High heat-resistant phenolics are used for bulb receptacles such as these. They serve for floodlights, beacons, movie projectors and searchlights and are lighter and less fragile than the porcelain receptacles they supplanted. They are molded of Durez by American Phenolic Corporation

9 Sperzel Sanitary Seat Co. has recently introduced this new type of public toilet seat with molded plastic seat pads and hinge covers, and a stainless steel frame. Smooth, lustrous seat pads, which are molded from a Bakelite phenolic material, are easy to clean and resistant to most chemicals and disinfectant cleaning solutions in common use. Chicago Molded Products Corp. and A. E. Neely, molders

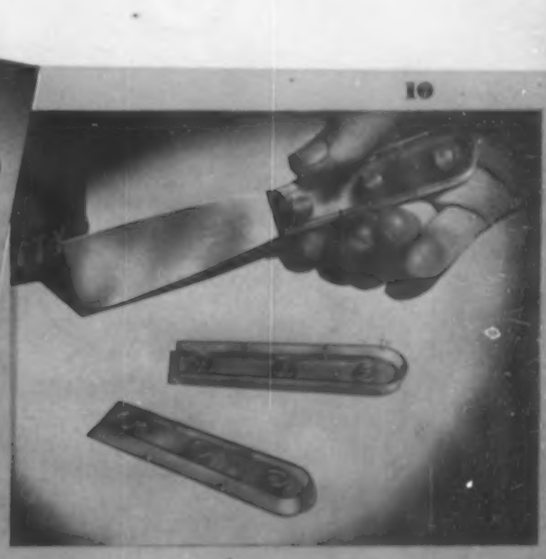
10 Red Devil putty knife is molded of transparent Fibestos in two parts. Parts are affixed to shank of the blade and held by brass compression rivets. Molded for Landon P. Smith, Inc., by Bridgeport Moulded Products, Inc.



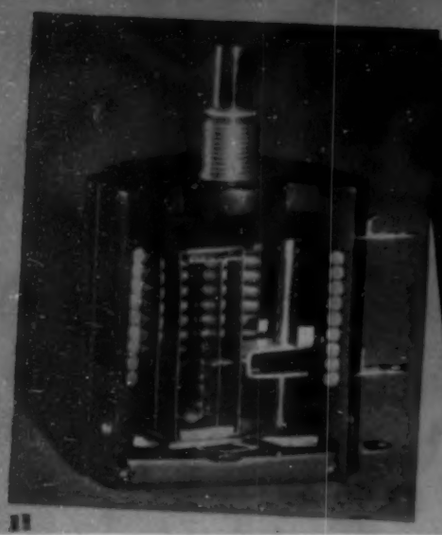
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11 Designed in Durez, the Helipot (helical potentiometer) has been placed on the market for practically all types of electrical instruments where a potentiometer or rheostat is now used for exacting control. Instead of the circular resistance wire being shaped into a round single ring as in conventional potentiometers, the new resistance winding of the Helipot has the form of a continuous helix like a machine thread. Housing wire is coiled into the case. Molded by McDonald Manufacturing Co. Can accommodate various lengths

12 Versatile plastics replace aluminum for cookie cutters in a wide variety of gay colors which won't chip or discolor. Molded by Advance Molding Corp. of Nixonite made from Hercules cellulose acetate base, they are light and washable. Distributed by Levin Brothers

13 Compact soap dispenser represents a successful change from spun metal with a wooden center piece to an all-plastic housing of molded Durez. Change to plastics eliminated moisture absorption and corrosion difficulties. According to the manufacturer, Great Stuff Products Co., the soap remains in better condition and the working parts of the dispenser are less subject to sticking with use of plastics. Molded by Minneapolis Plastic Molding Co.

14 Reading in bed is a comfort and a delight with this new Eagle Fluralamp with a heat-resistant Bakelite shade molded by Universal Plastics Corp. It is easily attached to any bed by two felt-lined clock spring clamps and will take a T12 14-watt, 15-in. fluorescent bulb. The lamp, 15 in. long, is equipped with a baked white enamel reflector for light intensity and can be used to illuminate pictures, bulletin boards, displays, etc.

15 Sparkling transparency distinguishes the unusual clothes hanger molded of Fibestos by Ben Hur Products, Inc. The natural toughness of the plastic makes the hanger strong, yet lightweight. A series of ribs molded in the hollow underside of the curved crosspiece gives added strength. Smooth surface prevents snagging and molded-in grooves keep garments from sliding off

16 No trouble at all to keep your knitting yarn clean and unsnarled in this transparent container. It is lightweight, pleasant to touch and cleans easily. Manufactured from Hercules cellulose acetate flake by Lapin Products, Inc., it is available in colors

17 New colorimeter by Hellige, Inc., has plastic housing so cleverly designed that the joints and seams are concealed and the optical system is kept free from dust. Light is concentrated in reading areas. Molded of Textolite by Plastics Dept., General Electric Company

18 Better electrical characteristics at high frequency, extremely low moisture absorption, low specific gravity and strength were reasons for use of a Plexiglas

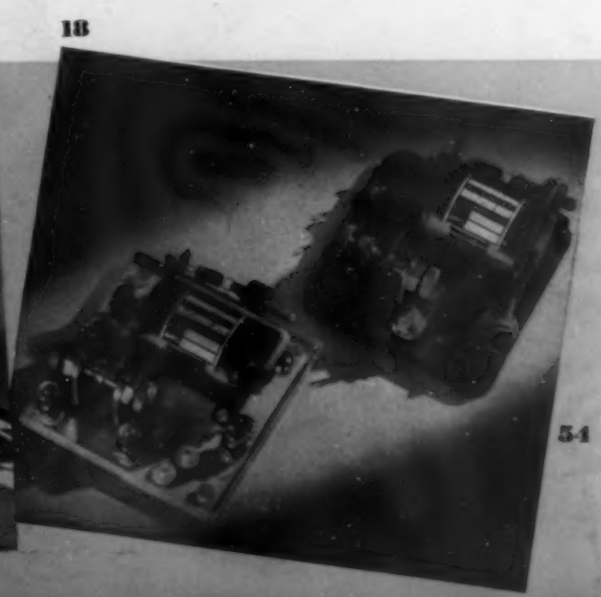


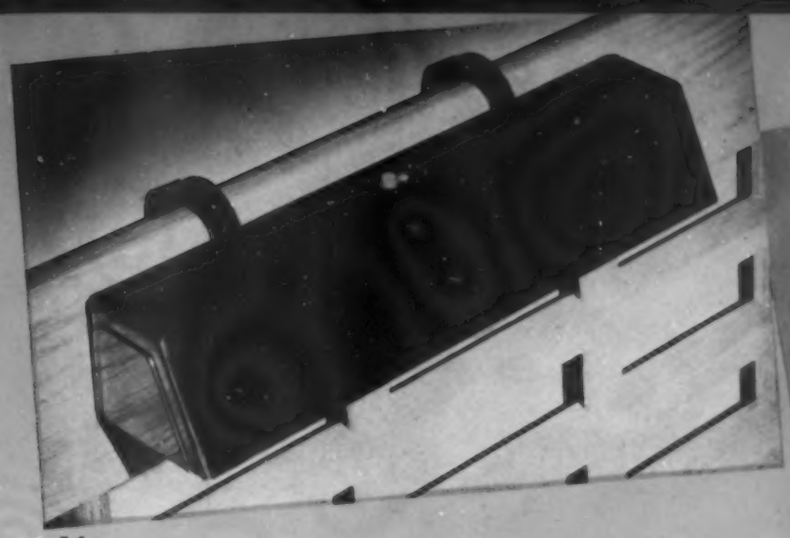
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base on these relays used in aerial military photography. Plastic resists destructive arcing at frequencies up to 75 megacycles, is resilient and impact resistant. Manufacturer, Kurman Electric Company

19 Perfect adjunct to the breakfast table, Westinghouse automatic toaster not only "pops-up" perfectly browned toast, but also controls its crispness. Cover which, when inverted, forms a serving rack, is molded of Bakelite by Bay City Div., Electric Autolite Co. Base by Boonton Molding Company

20 Portable fluorescent light, encased in a tube of transparent Lucite, speeds night work on airplane assembly lines by providing proper illumination for confined and inaccessible working areas. Craftsmen find the light handy because of the low wattage and light weight. It throws off spherical lighting, thus eliminating shadows in limited working areas. End pieces and internal as sembly by Modern Plastics Co. for Day Ray Products

PLASTICS IN REVIEW



19



20



THE COCHRANE SURGICAL WINDOW

The base is only 3 inches square, the integral upright cylinder 1¼ inches in height and 1½ inches in diameter. The cup fits the full depth into the cylinder and is held in place by its lip, which fits snugly over the shoulder at the top of the cylinder, shutting out the air. Molded by The Niagara Insul-Bake Specialty Company, Inc., Albany, New York, for the American Hospital in Britain.



To Strengthen the Spirit that Will Beat the Bombs!

● The invader passes. Below him lies the rubble of blasted buildings and the twisted bodies of human beings. But far above him rises Britain's spirit, each day more determined in purpose . . . each day stronger in pursuit of ultimate Victory.

In this struggle for Victory, Plaskon is an effective new weapon. Molded into "surgical windows," it has helped the American Hospital in Britain evolve a revolutionary leave-it-alone treatment for compound fractures and bomb-shattered limbs.

The fractured limb of the bomb victim is set and the open wound treated with sulphathiazole. Then the whole member is completely encased with plaster, in which the Plaskon cup and window unit is mounted directly over the wound. The limb then is left alone for weeks at a time. Infection is fought not by local application of irritating antiseptics but via the bloodstream of the patient, through intravenous injections of the new sulpha drugs. At regular intervals, the cup is lifted from its socket, progress of healing and changes in the wound observed and cultures taken. The physical pain and mental agony of frequent redressing are spared the patient, and he advances quickly toward recovery.

Plaskon was chosen for this new and revolutionary surgical advancement because it is chemically inert, cannot corrode, is non-porous, can be readily cleaned and sterilized, and will not conduct heat or cold through the cast into the wound.

At home and abroad, Plaskon plays an important part in the actual building of forces "that will beat the bombs," and in aiding the civil and defense production requirements of industry. Plaskon Company, Inc., 2121 Sylvan Avenue, Toledo, Ohio. Canadian Agent: Canadian Industries, Limited, Montreal, P. Q.

PLASKON

TRADE MARK REGISTERED

MOLDED COLOR

Stock molds

SHEET ONE HUNDRED-FOURTEEN

Decorative knobs, bottle caps can be adapted for various purposes. Novelty disks can be imprinted with advertising or trademarks. All are available from stock molds without mold cost. Address Modern Plastics, Chanin Building, New York, giving item and sheet numbers

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1370. Knob with metal shaft insert; 1 1/2 in. diameter; 7/8 in. high

1371. Knob with 1/8 in. shaft; 1 1/2 in. diameter; 7/8 in. high. 1/8 in. in from edge

1372. Knob with decorated sidewall; 7/8 in. diameter; overall height 1/2 in.; 1/4 in. molded center opening or brass insert

1373. Knob with decorated sidewall; 7/8 in. diameter; 11/16 in. overall height; 1/8 in. center shaft opening

1374. Lightweight tags for key chains or necks of bottles; 1 5/16 in. diameter; measures 1 1/2 in. from punched loop. Trademark insignia printed in colors desired

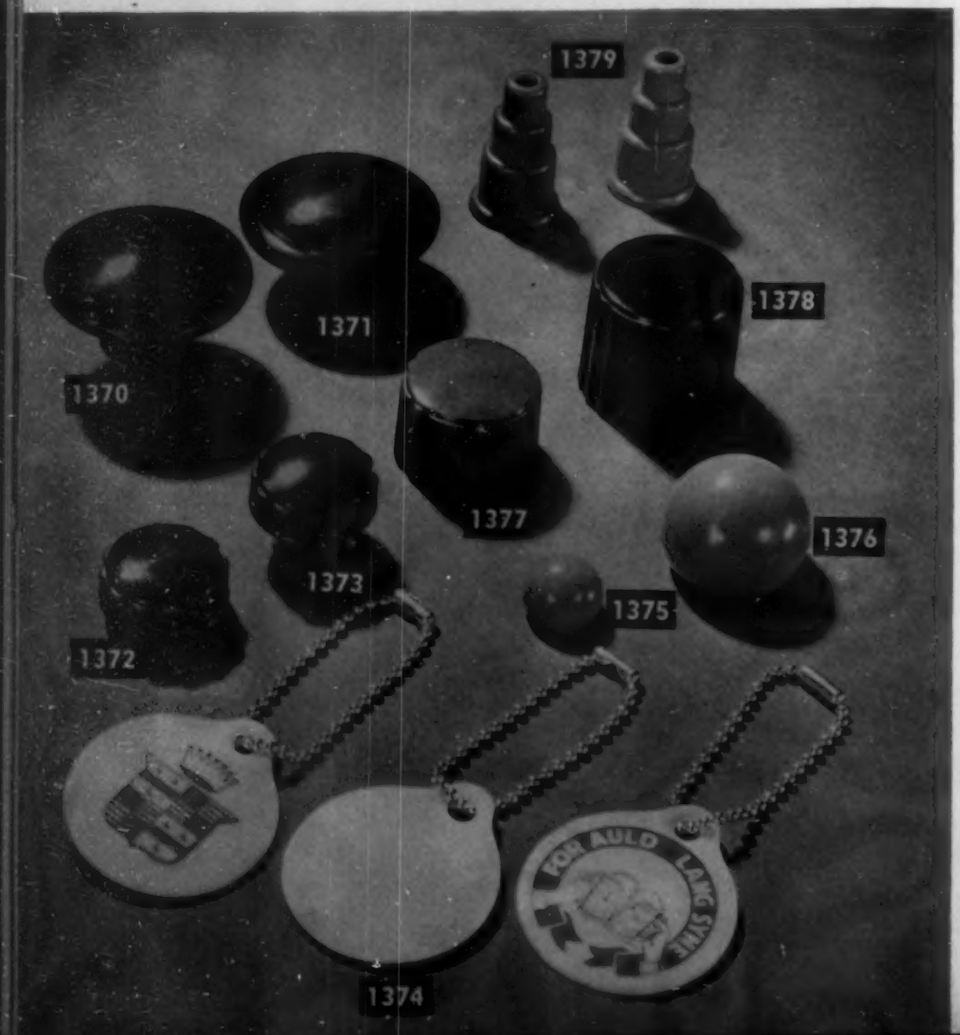
1375. Threaded 10 mm. medium ball-shaped cap; 7/16 in. diameter at base; 7/16 in. high. Lined with cork and tin

1376. Threaded 18 mm. medium ball-shaped cap; 3/4 in. diameter at base; 7/8 in. high

1377. Cork and tin lined 22 mm. medium threaded cap with fluted sidewall; 1 in. diameter; 11/16 in. high. In yellow and green

1378. Lined, medium threaded 22 mm. cap with fluted sidewall; 1 in. high; 1 1/16 in. diameter

1379. Cord pulls, 1 1/4 in. high; 11/16 in. diameter of base; 7/16 in. diameter of opening at base; 1/4 in. diameter of top; 3/16 in. diameter of top opening. Available in stock colors: red and light blue



All molders are invited to send samples from stock molds to appear on this page as space permits

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Resistance of plastics to chemical reagents[1]

by G. M. KLINE,[2] R. C. RINKER,[2] and H. F. MEINDL[3]

IN the tabulation of data on plastics for handbooks and manufacturers' bulletins, information regarding the effect of various chemical reagents on these materials is generally included. The selection of compounds and concentrations for use in such tests was given early consideration by Committee D-20 on Plastics, and Tentative Method of Test D 543 – 39 T for Resistance of Plastics to Chemical Reagents was included in the first group of methods adopted by that Committee. This provided not only a uniform test procedure for use in purchase specifications, but also a guide to investigators so that data obtained on new plastics would be comparable with those in the literature for other plastic materials.

The limitations of this method as well as of other test methods involving the permanence properties of plastics should be recognized. The choice of reagents typical of the range of acids, alkalies, salt solutions, solvents and other chemicals which may be encountered in service is necessarily arbitrary. For most applications it will be necessary to test the plastic, which is under consideration for fabricating the part, in contact with a particular chemical. However, rather than confine the method to a statement of testing procedure without listing any reagents or extend the list indefinitely to include all compounds and concentrations of solutions proposed by committee members, an effort was made to choose those reagents which would be representative of strong and weak acids, strong and weak alkalies, salt solutions, and the various types of organic solvents, such as alcohols, ketones, esters, and aliphatic, aromatic and halogenated hydrocarbons.

Another limiting factor in the practical value of the results obtained in this test is the relatively short time of immersion specified, namely, 7 days. For applications involving continuous immersion in chemicals, the data obtained in a short-time test are of interest only in eliminating the most unsuitable materials. Furthermore, the criteria of changes in weight, dimensions and appearance are often insufficient to reveal adverse effects of the chemicals on the strength and electrical properties of the plastics. On the other hand, many instances have been reported of industrial applications of plastics in which the surface appearance is marred by contact with chemicals, but the serviceability of the plastic is not appreciably reduced. The period of immersion and the properties to be measured were, as in the case of the chemicals, selected primarily to serve as a guide to investigators wishing to compare the relative resistance to chemicals of different plastics. Those with special problems in the application of plastics under corrosive conditions must necessarily fit to their special needs the duration of contact with the chemical, the temperature of the system and the physical tests used in determining the suitability of the plastic.

The experimental data reported in this paper were obtained in an exploratory investigation undertaken by Subcommittee V on Permanence Properties of A.S.T.M. Committee D-20 on Plastics in connection with the preparation of the present tentative standard method for evaluating the resistance of plastics to chemicals. The experimental results should be interpreted in accordance with the limitations inherent in the test method, as previously discussed.

Materials and test methods

The plastics examined were molded, cast and paper-base laminated phenol-formaldehyde materials, molded

TABLE I. THICKNESSES AND SPECIFIC GRAVITIES OF THE PLASTICS

Material	Thickness, Mils	Specific Gravity
Phenol-formaldehyde molded	128	1.40
Phenol-formaldehyde cast	127	1.29
Phenol-formaldehyde laminated	134	1.33
Urea-formaldehyde molded	125	1.47
Urea-formaldehyde laminated	132	1.46
Vinyl chloride-acetate resin	133	1.35
Vinyl butyral resin	122	1.09
Methyl methacrylate resin	139	1.16
Styrene resin (molded)	126	1.03
Styrene resin (cast)	156	1.03
Cellulose nitrate	123	1.36
Cellulose acetate	133	1.28
Ethylcellulose No. 1	185	1.10
Ethylcellulose No. 2	166	1.12
Cold-molded phenolic	128	2.09
Cold-molded bituminous	130	1.87
Casein	121	1.25

[1] This paper was presented at the Annual Meeting of the American Society for Testing Materials in Chicago, Ill., June 24, 1941, and is published here by permission of that Society.

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TABLE II. PERCENTAGE CHANGES IN WEIGHT AND DIMENSIONS OF

	Phenol-Formaldehyde Molded	Phenol-Formaldehyde Cast	Phenol-Formaldehyde Laminated	Urea-Formaldehyde Molded	Urea-Formaldehyde Laminated	Vinyl Chloride-Acetate Resin
				Percentage change in weight when		
30% Sulfuric acid	1.9	0.1	0.5	0.2	−0.2	0.04
3% Sulfuric acid	1.6	0.5	2.1	1.0	0.6	0.09
10% Nitric acid	6.2	0.4	1.7	1.4	0.4	0.08
10% Hydrochloric acid	4.8	0.3	1.4	0.3	0.1	0.09
5% Acetic acid	1.0	0.6	1.8	1.7	1.1	0.11
Oleic acid	0.2	0.1	0.2	0.4	0.2	0.02
10% Sodium hydroxide	43.	D	92.	1.0	1.3	0.09
1% Sodium hydroxide	1.3	6.4	5.0	1.8	1.3	0.09
10% Ammonium hydroxide	1.0	4.7	2.6	2.2	1.6	0.16
2% Sodium carbonate	1.4	0.6	2.0	3.0	0.9	0.08
10% Sodium chloride	0.5	0.4	1.4	1.2	0.8	0.09
3% Hydrogen peroxide	1.3	1.0	2.5	1.8	7.1	0.09
Distilled water	0.8	0.5	2.2	2.0	1.1	0.09
50% Ethyl alcohol	0.6	1.5	0.9	2.4	0.7	0.07
95% Ethyl alcohol	−0.05	0.04	0.03	−0.3	0.0	0.00
Acetone	−0.2	0.6	13.	−0.8	−0.6	S
Ethyl acetate	−0.1	−0.3	0.4	−0.4	−0.7	B
Ethylene chloride	−0.07	−0.1	−0.07	−0.3	−0.1	B
Carbon tetrachloride	0.00	0.08	0.03	0.06	0.2	0.14
Toluene	0.2	−0.02	0.04	0.5	0.05	79.
Gasoline	−0.07	−0.04	−0.01	−0.2	−0.05	−0.01
				Percentage change in length[a] ±0.03		
30% Sulfuric acid	0.05	0.03	0.00	0.10	0.03	−0.03
3% Sulfuric acid	0.15	0.10	0.07	0.45	0.16	0.00
10% Nitric acid	0.05	0.00	0.07	0.28	0.10	0.07
10% Hydrochloric acid	0.40	0.07	0.02	0.25	0.10	−0.03
5% Acetic acid	0.20	0.10	0.05	0.35	0.13	−0.03
Oleic acid	0.00	0.03	−0.02	0.10	0.00	−0.03
10% Sodium hydroxide	3.8	A	0.73	0.25	0.06	−0.10
1% Sodium hydroxide	0.15	0.42	0.08	0.45	0.03	0.00
10% Ammonium hydroxide	−0.05	0.23	0.07	0.30	0.07	0.00
2% Sodium carbonate	0.20	0.00	0.10	0.86	0.06	0.02
10% Sodium chloride	0.25	0.07	0.04	0.35	0.08	−0.10
3% Hydrogen peroxide	−0.25	0.07	0.07	0.35	0.24	−0.03
Distilled water	0.40	0.09	0.08	0.70	0.11	0.06
50% Ethyl alcohol	0.15	0.10	0.07	0.45	0.07	0.00
95% Ethyl alcohol	0.20	0.02	0.00	0.10	−0.01	0.00
Acetone	0.00	0.11	0.18	−0.15	−0.10	A
Ethyl acetate	0.00	−0.03	0.02	−0.05	−0.10	A
Ethylene chloride	−0.25	0.02	0.02	−0.15	0.03	A
Carbon tetrachloride	0.00	0.04	0.01	0.00	0.05	−0.02
Toluene	0.05	−0.03	0.02	0.05	0.00	21.
Gasoline	0.00	−0.07	−0.03	0.05	−0.13	−0.03
				Percentage change in thickness ±0.8		
30% Sulfuric acid	1.6	−0.8	1.5	0.8	0.4	0.0
3% Sulfuric acid	1.6	0.8	3.0	0.0	0.0	0.8
10% Nitric acid	6.4	0.0	4.6	0.8	1.5	0.0
10% Hydrochloric acid	6.3	−0.8	2.7	0.8	1.2	0.0
5% Acetic acid	1.6	0.0	2.2	0.0	0.8	0.0
Oleic acid	0.0	0.0	0.4	0.8	0.4	0.0
10% Sodium hydroxide	57.	A	110.	0.0	0.8	0.0
1% Sodium hydroxide	1.6	14.	8.4	0.0	0.8	0.0
10% Ammonium hydroxide	1.6	4.7	4.4	0.8	2.3	0.0
2% Sodium carbonate	0.8	0.0	3.8	2.4	−0.4	−0.4
10% Sodium chloride	0.0	0.8	1.9	0.8	0.0	0.0
3% Hydrogen peroxide	1.6	0.8	1.5	0.0	18.	0.0
Distilled water	0.8	0.0	2.5	1.6	0.0	0.0
50% Ethyl alcohol	1.6	1.6	1.4	1.6	0.0	0.0
95% Ethyl alcohol	0.8	−0.4	2.3	0.8	0.0	0.0
Acetone	0.8	4.2	43.	0.0	−1.2	A
Ethyl acetate	−1.6	0.0	0.8	−1.6	0.0	A
Ethylene chloride	0.8	−0.4	0.4	0.0	0.0	A
Carbon tetrachloride	0.8	0.0	0.4	1.5	0.0	−0.4
Toluene	−0.8	0.0	1.0	−1.8	0.0	48.
Gasoline	1.6	−0.8	0.0	0.0	0.0	0.0

A = Action of reagent on sample made measurements of dimensional changes impractical or impossible.
B = Disintegrated by swelling or breaking up; D = Decomposed; S = Dissolved.

Plastics Immersed for 7 Days in Chemical Reagents at 25 deg. C.

Vinyl Butyral Resin	Methyl Methacrylate Resin	Styrene Resin Molded	Styrene Resin Cast	Cellulose Nitrate	Cellulose Acetate	Ethyl-Cellulose No. 1	Ethyl-Cellulose No. 2	Cold-Molded Phenolic	Cold-Molded Bituminous	Casein Plastic
immersed in reagent for 7 days										
0.6	0.3	0.01	0.02	0.6	0.8	0.7	0.8	−8.4	−3.7	24.
1.8	0.6	0.03	0.05	1.4	3.8	1.6	2.2	−1.6	0.09	48.
3.0	0.5	0.03	0.03	1.4	D	1.3	2.1	−3.0	−0.4	27.
1.5	0.5	0.03	0.05	1.3	11.	1.2	1.2	−8.80	−4.7	34.
3.3	0.7	0.05	0.05	1.6	6.5	1.9	2.9	0.2	1.2	45.
12.	0.2	0.02	0.01	0.1	0.1	B	B	2.1	1.8	0.6
1.2	0.5	0.02	0.04	−1.8	73.	1.1	1.3	D	6.9	D
2.2	0.6	0.03	0.04	0.2	3.3	1.5	2.0	10.	3.0	D
2.8	0.6	0.10	0.15	8.0	5.8	1.6	3.0	3.0	4.5	105.
2.2	0.6	0.04	0.03	1.2	2.6	1.5	1.9	2.0	2.4	43.
1.5	0.5	0.02	0.04	1.2	2.8	1.2	1.6	1.8	1.6	17.
2.6	0.7	0.04	0.05	1.4	4.5	1.9	2.1	0.2	0.9	42.
2.5	0.7	0.03	0.03	1.5	4.6	1.7	2.1	1.7	1.4	30.
62.	3.4	0.10	0.11	6.4	25.	38.	36.	1.6	3.2	25.
S	11.	0.22	0.14	S	15.	S	S	2.1	2.5	0.4
205.	S	S	S	S	S	S	S	3.4	3.9	−3.8
B	S	S	S	S	S	S	S	1.6	5.5	2.4
426.	S	S	S	34.	112.	S	S	1.8	12.2	−0.3
145.	−24.	S	S	0.20	2.2	S	S	1.9	13.6	−0.2
107.	S	S	S	3.4	1.2	S	S	1.6	7.5	−0.1
0.8	0.04	26.	31.	0.03	−0.3	109.	106.	1.4	3.0	−0.1
when immersed in reagent for 7 days										
0.13	0.07	0.00	−0.07	0.10	0.17	0.17	0.14	−0.05	−0.10	2.
0.23	0.10	0.00	0.02	0.33	1.03	0.33	0.40	0.05	0.30	15.
0.23	0.10	−0.15	−0.02	0.32	A	0.23	0.44	0.00	0.25	9.
0.16	0.07	0.00	−0.10	0.25	1.2	0.16	0.30	0.10	0.20	5.
0.26	0.13	0.05	0.03	0.57	1.6	0.26	0.40	0.05	0.40	14.
0.47	0.03	0.05	0.00	0.00	0.04	A	A	0.00	0.10	0.17
0.15	0.10	0.05	0.07	0.10	1.1	0.20	0.24	A	0.96	A
0.16	0.17	0.00	−0.07	0.33	1.3	0.30	0.50	1.67	0.35	A
0.20	0.10	−0.05	0.00	1.5	−2.4	0.28	0.74	0.05	0.35	32.
0.22	0.17	0.00	0.00	0.26	0.73	0.26	0.44	0.25	0.30	14.
0.17	0.03	−0.05	0.03	0.27	0.83	0.17	0.32	0.25	0.35	4.
0.22	0.13	−0.10	0.00	0.44	0.99	0.26	0.36	0.00	0.25	17.
0.20	0.16	0.00	0.02	0.42	1.2	0.32	0.48	0.30	0.30	11.
11.	0.20	0.10	0.00	0.90	1.3	4.7	5.7	0.20	0.76	6.
A	0.43	0.05	0.03	A	−0.20	A	A	0.40	0.40	−0.3
A	A	A	A	A	A	A	A	2.2	0.50	−1.2
A	A	A	A	A	A	A	A	0.25	0.76	−0.6
A	A	A	A	0.66	24.	A	A	0.10	2.3	−0.2
16.	−0.50	A	A	0.02	0.18	A	A	0.00	2.1	−0.1
A	A	A	A	0.28	0.38	A	A	0.05	1.8	−0.1
0.10	0.00	A	A	0.00	0.05	A	A	0.05	0.50	1.7
when immersed in reagent for 7 days										
0.5	0.0	0.7	0.0	0.0	0.0	0.6	0.3	0.8	1.5	16.
0.9	0.0	0.0	−0.3	0.8	2.3	0.5	0.9	0.0	0.0	18.
1.7	0.7	−0.8	−0.3	0.8	A	0.0	0.6	2.3	4.6	20.
0.4	0.0	0.0	0.0	0.0	11.7	0.3	0.3	1.5	2.4	19.
1.6	0.0	−0.8	0.0	0.8	4.2	0.8	0.9	0.0	0.8	22.
16.	0.4	0.0	0.6	0.4	0.0	A	A	0.0	0.0	0.8
0.4	0.0	0.0	0.0	−2.1	85.	0.6	0.3	A	3.9	A
1.3	0.8	0.0	1.3	−1.2	1.9	1.1	0.9	11.5	0.0	A
2.0	0.0	0.0	0.0	7.8	39.	0.0	1.2	1.5	1.6	46.
0.4	0.0	0.0	0.0	0.8	1.5	0.3	0.3	4.8	1.5	16.
0.4	0.8	0.0	0.0	0.0	1.5	0.0	−0.3	0.8	0.0	11.
1.2	0.8	0.0	0.0	0.4	3.0	0.5	0.3	0.8	0.0	15.
1.2	0.0	0.8	−0.3	0.0	2.8	0.3	0.3	1.6	0.0	13.
43.	3.3	0.0	0.0	9.1	43.	31.	30.	−0.8	1.6	14.
A	15.	0.0	−0.7	A	38.	A	A	2.3	0.8	0.8
A	A	A	A	A	A	A	A	2.3	2.3	−3.
A	A	A	A	A	A	A	A	0.8	1.5	−1.5
A	A	A	A	31.	43.	A	A	4.2	9.3	−1.2
91.	−7.4	A	A	0.0	0.0	A	A	0.0	3.8	−1.7
A	A	A	A	7.0	4.9	A	A	−0.8	3.1	−0.8
3.8	−0.4	A	A	−0.4	0.0	A	A	−0.8	1.6	−0.4

• For molded specimens, value in length column is change in diameter. (*Please turn to next page*)

TABLE III. PERCENTAGE CHANGES IN WEIGHT AND DIMENTIONS OF PLASTICS AFTER IMMERSION FOR 7 DAYS RELATIVE HUMID-

	Phenol-Formaldehyde Molded	Phenol-Formaldehyde Cast	Phenol-Formaldehyde Laminated	Urea-Formaldehyde Molded	Urea-Formaldehyde Laminated	Vinyl Chloride-Acetate Resin
	Percentage change from original weight after immersion in reagent for 7 days and					
30% Sulfuric acid	1.2	0.0	0.2	−1.2	−1.0	0.0
3% Sulfuric acid	0.7	0.1	0.5	−1.3	−0.3	0.0
10% Nitric acid	2.6	0.2	0.8	−1.4	−2.2	0.0
10% Hydrochloric acid	1.8	0.1	0.5	−1.9	−3.2	0.0
5% Acetic acid	0.3	0.1	0.6	0.3	0.4	0.0
Oleic acid	0.4	0.1	0.2	0.8	0.3	0.0
10% Sodium hydroxide	16.	A	30.	0.1	0.0	0.0
1% Sodium hydroxide	0.7	−2.5	0.9	0.4	0.2	0.0
10% Ammonium hydroxide	0.0	1.2	0.6	0.9	0.3	0.1
2% Sodium carbonate	0.7	0.1[a]	0.5	1.1	0.3	0.0
10% Sodium chloride	0.3	0.1	0.5	0.2	0.3	0.0
3% Hydrogen peroxide	0.6	0.3[a]	0.5	0.7	−17.	0.0
Distilled water	0.4t	0.2	0.6	0.6[a]	0.4	0.0
50% Ethyl alcohol	−0.2	−0.1	0.3	0.9	0.1	0.0
95% Ethyl alcohol	0.1	−0.1	0.1	0.1	0.3	0.0
Acetone	0.0	0.0	4.3	−0.2	0.3	A
Ethyl acetate	0.1	−0.1	0.4	0.1	0.0	A
Ethylene chloride	0.0	0.0	0.0	−0.3	0.1	A
Carbon tetrachloride	−0.2	0.1	0.2	−0.2	0.2	0.1
Toluene	−0.1	−0.1	0.2	0.0	0.1	16.
Gasoline	0.0	0.0	0.1	−0.1	0.0	0.0
	Percentage change from original length[b] after immersion in reagent for 7 days and					
30% Sulfuric acid	0.0	0.1	0.0	−0.1	0.0	0.1
3% Sulfuric acid	0.1	0.0	0.0	0.0	0.1	0.1
10% Nitric acid	−0.2	−0.1	0.0	−0.1	0.0	0.0
10% Hydrochloric acid	−0.1	0.0	0.0	−0.2	0.1	0.0
5% Acetic acid	0.1	0.0	0.0	0.1	0.1	0.0
Oleic acid	0.0	0.0	0.0	0.2	0.0	0.0
10% Sodium hydroxide	1.9	A	−0.8	0.0	0.1	0.0
1% Sodium hydroxide	0.0	0.0	0.0	0.0	0.0	0.0
10% Ammonium hydroxide	0.0	0.1	0.0	0.2	0.0	0.0
2% Sodium carbonate	0.2	0.0[a]	0.0	0.4	0.1	0.0
10% Sodium chloride	0.1	0.0	0.0	0.1	0.1	0.0
3% Hydrogen peroxide	−0.1	0.0[a]	0.0	0.3	0.1	0.1
Distilled water	0.3[a]	0.0	0.0	0.3[a]	0.1	0.0
50% Ethyl alcohol	0.0	−0.1	0.0	0.1	0.0	0.0
95% Ethyl alcohol	0.1	0.0	0.0	0.1	0.0	0.0
Acetone	−0.1	0.0	0.0	−0.2	0.0	A
Ethyl acetate	0.1	0.0	0.0	0.2	0.0	A
Ethylene chloride	−0.1	0.0	0.0	−0.1	0.0	A
Carbon tetrachloride	−0.3	0.0	0.0	−0.2	0.0	0.0
Toluene	−0.1	−0.1	0.0	0.0	0.0	0.9
Gasoline	0.1	0.0	0.0	0.1	−0.1	0.0
	Percentage change from original thickness ±0.8 after immersion in reagent for 7 days					
30% Sulfuric acid	0.8	0.8	0.0	0.0	1.3	0.0
3% Sulfuric acid	1.6	0.0	0.0	−0.8	−0.4	0.8
10% Nitric acid	4.0	0.4	2.3	0.0	1.0	0.0
10% Hydrochloric acid	3.9	0.0	0.0	0.8	0.8	0.0
5% Acetic acid	0.0	−0.8	0.4	0.0	0.8	0.0
Oleic acid	0.0	0.0	0.0	0.4	0.0	0.0
10% Sodium hydroxide	30.	A	53.	0.0	0.0	0.7
1% Sodium hydroxide	0.0	2.7	1.9	0.0	0.0	0.0
10% Ammonium hydroxide	0.0	0.8	0.0	0.8	0.8	0.0
2% Sodium carbonate	−0.8	0.0[a]	0.0	0.0	0.0	−0.4
10% Sodium chloride	0.0	0.8	0.4	0.0	0.0	0.0
3% Hydrogen peroxide	0.8	0.8[a]	0.0	−1.5	10.	0.0
Distilled water	0.0[a]	−0.4	0.8	0.8[a]	−0.4	0.0
50% Ethyl alcohol	0.8	0.0	0.7	0.0	0.0	0.0
95% Ethyl alcohol	0.0	−0.4	0.0	0.8	0.0	0.0
Acetone	0.8	1.2	8.6	0.0	0.0	A
Ethyl acetate	−1.6	0.0	0.4	−1.6	0.0	A
Ethylene chloride	0.0	0.0	0.4	−0.8	0.0	A
Carbon tetrachloride	0.8	−0.4	0.3	0.8	0.0	−0.4
Toluene	0.0	0.0	0.4	−0.8	0.0	24.
Gasoline	−0.8	0.8	0.0	0.0	0.0	0.0

IN CHEMICAL REAGENTS AT 25 DEG. C. AND SUBSEQUENT EXPOSURE TO AIR AT 25 DEG. C. AND 50 PERCENT ITY FOR 4 WEEKS

Vinyl Butyral Resin	Methyl Methacrylate Resin	Styrene Resin Molded	Styrene Resin Cast	Cellulose Nitrate	Cellulose Acetate	Ethyl-Cellulose No. 1	Ethyl-Cellulose No. 2	Cold-Molded Phenolic	Cold-Molded Bituminous	Casein Plastic
subsequent exposure to air at 77° F. and 50% relative humidity for 28 days										
0.2	0.0	0.0	0.0	−0.1	−3.4	0.2	0.2	−13.	−7.6	12.
0.5	0.0	0.0	0.0	0.0	−0.7	0.2	0.3	−4.7	−4.3	8.7
0.7	0.2	0.0	0.0	0.3	A	0.3	0.5	−6.3	−5.3	−2.2
0.4	0.1	0.0	0.0	0.2	−9.9	0.2	0.3	−13.	−10.	−2.9
0.8	0.2	0.0	0.0	0.2	0.3	0.1	0.5	−1.1	−0.3	−3.7
12.	0.2	0.0	0.0	−0.2	0.2	A	A	1.9	1.7	0.7
0.4	0.1	0.0	0.0	−2.2	−18.	0.1	0.2	A	2.2	A
0.5	0.1	0.0	0.0	−1.2	−8.3	1.2[a]	0.2	−0.1	0.4	A
0.7	0.2	0.0	0.0	−1.9	−38.	0.0	0.6	−1.5	−1.7	0.3
0.6	0.1	0.0	0.0	−0.2[a]	−2.5	0.0	0.2	0.5	0.2	5.4
0.5	0.1	0.0	0.0	0.0	−0.2	0.1	0.2	0.1	0.3	3.6
0.6	0.1	0.0	0.0	0.1	−1.5	−0.1	0.1	−0.8	−1.2	1.5
0.6	0.1	0.0	0.0	0.1	−0.7	0.2	0.1	0.1[a]	0.3[a]	0.3
8.7	0.8	0.0	0.0	−1.7	−11.	3.2	2.1	0.0	0.0	3.8
A	1.9	0.0	0.6	A	−13.	A	A	0.3	0.3	0.3
A	A	A	A	A	A	A	A	−0.2	−0.3	−1.0
A	A	A	A	A	A	A	A	0.4	−0.6	0.2
A	A	A	A	−3.8	−12.	A	A	0.2	−1.6	0.1
33.	−13.	A	A	0.2	−0.3	A	A	0.0	−1.6	0.3
8.2	A	A	A	−1.4	−4.2	A	A	0.0	−1.3	0.2
0.4	0.1	A	A	−0.6	−0.2	2.1	A	0.1	0.7	0.2
subsequent exposure to air at 77° F. and 50% relative humidity for 28 days										
0.1	0.0	−0.1	0.1	0.0	−0.2	0.0	0.0	−0.1	−0.3	0.3
−0.1	0.0	−0.1	−0.1	−0.1	−0.7	0.0	−0.1	−0.1	0.0	4.2
0.1	0.0	−0.2	0.0	0.0	A	0.0	0.1	−0.2	−0.1	−0.3
0.1	0.0	−0.2	−0.1	0.0	−0.1	0.0	0.0	−0.1	−0.2	0.2
0.2	0.0	0.1	−0.1	0.1	−0.6	0.0	−0.1	0.0	0.2	2.4
0.2	0.0	0.0	0.0	−0.1	0.0	A	A	0.0	0.1	0.1
0.1	0.0	−0.1	0.0	−0.2	−34.	0.0	0.0	A	0.1	A
0.0	0.0	0.0	0.1	0.1	−1.3	0.1[a]	0.1	0.5	0.1	A
0.0	0.0	−0.1	0.0	−0.2	−25.	0.0	0.1	0.1	0.1	1.0
0.1	0.1	0.1	0.0	−0.1[a]	−1.0	0.0	0.0	0.0	0.0	3.0
0.0	0.0	0.0	0.0	−0.1	−0.2	0.0	0.0	0.2	0.3	0.4
0.0	0.1	−0.1	0.0	0.0	−0.9	0.0	0.0	0.0	−0.2	4.7
−0.1	0.0	0.0	0.0	0.0	−0.7	0.0	−0.1	0.1[a]	−0.1[a]	2.0
0.1	0.0	0.0	0.0	−2.8	−6.7	−0.2	0.3	0.0	−0.1	0.4
A	0.0	−0.1	0.0	A	−12.	A	A	0.1	0.2	0.0
A	A	A	A	A	A	A	A	0.1	−0.3	−0.5
A	A	A	A	A	A	A	A	0.2	0.0	0.1
A	A	A	A	−13.	6.9	A	A	0.0	0.3	0.0
−1.5	−0.4	A	A	−0.1	0.0	A	A	−0.2	0.3	0.1
−3.3	A	A	A	−1.7	−0.9	A	A	−0.1	−0.2	0.0
0.0	0.0	A	A	−0.1	0.0	8.5	A	0.0	0.4	0.1
and subsequent exposure to air at 77° F. and 50% relative humidity for 28 days										
0.0	0.0	0.0	0.0	0.0	−3.8	0.0	0.4	0.0	2.3	7.3
0.4	0.0	0.0	0.0	0.0	0.0	0.5	0.3	−1.6	−3.9	1.7
0.4	0.4	0.0	0.7	0.8	A	0.0	0.3	0.0	1.5	15.
−0.4	0.0	0.0	0.0	0.0	0.7	0.3	0.7	0.8	0.8	11.
0.8	0.0	0.9	0.0	0.0	1.9	0.3	0.0	−0.8	0.0	1.8
13.	0.0	0.0	0.3	0.0	0.0	A	A	0.5	2.0	0.8
0.0	0.0	0.0	0.0	−2.1	80.	0.6	0.0	A	0.0	A
0.4	0.8	0.8	0.0	−1.3	−6.4	0.6[a]	0.3	1.5	0.0	A
1.1	0.0	−0.4	0.0	2.5	7.1	0.0	0.0	−0.8	2.3	4.7
0.0	0.0	0.0	0.0	0.0[a]	0.0	0.6	0.0	0.8	0.0	0.9
0.8	0.0	0.0	0.0	0.0	0.0	0.0	−0.3	0.8	0.0	2.8
0.0	0.0	0.0	0.0	0.0	1.5	0.3	0.0	0.0	0.0	5.1
0.8	0.0	0.8	0.0	0.0	0.8	0.0	0.0	−4.0[a]	−0.8[a]	0.8
25.	1.1	0.0	0.0	4.2	21.	31.	15.	0.8	1.6	4.8
A	3.3	0.0	0.0	A	20.	A	A	1.6	0.0	0.0
A	A	A	A	A	A	A	A	0.8	0.8	−2.5
A	A	A	A	A	A	A	A	0.0	−1.5	0.0
A	A	A	A	19.	A	A	A	0.0	0.8	−0.8
23.	−2.1	A	A	0.0	−0.8	A	A	0.0	−0.8	0.0
19.	A	A	A	−2.5	−0.4	A	A	0.0	1.5	0.0
0.0	0.0	A.	A	−1.2	−0.4	33.	A	−2.3	−0.8	0.0

[a] These values were obtained 7 days after removal from the reagent.
[b] For molded specimens, value in length column is change in diameter.

(*Please turn to next page*)

and paper-base laminated urea-formaldehyde materials, casein, cellulose nitrate, cellulose acetate, ethylcellulose, polyvinyl chloride-acetate, polyvinyl butyral, polystyrene in molded and cast forms, polymethyl methacrylate, and cold-molded plastics of the bituminous and phenolic types. The thicknesses and specific gravities of the specimens are listed in Table I. These plastics were obtained from commercial sources and many of them contained the plasticizers ordinarily used in such compositions. Specimens 1 by 3 in. were cut from the sheet materials which were approximately 1/8 in. thick. The molded specimens were disks 2 in. in diameter and 1/8 in. thick. The surface areas on these two forms of specimens are approximately equal, which is desirable in absorption tests.

The specimens were placed on edge in test tubes or beakers and totally immersed in approximately 60 ml. of the reagents which were prepared in accordance with the directions given in the A.S.T.M. test (see reference 6 in Bibliography). After immersion for 7 days at 25 deg. C., the specimens were removed from the reagents, rinsed in water as prescribed by the standard procedure, wiped with a dry cloth, and weighed without delay. The diameter or length and the thickness were measured immediately after weighing. The specimens were left in a room conditioned at 25 deg. C. and 50 percent relative humidity and the weights and dimensions were measured 1 week and 4 weeks after removal from the reagent to determine the results.

An analytical chemical balance was employed for determining the weights of the specimens. Dimensions were measured with dial gages reading to 0.001 in. and having approximately 400 g. per sq. cm. pressure on the foot. All percentage changes in weights and dimensions are calculated on the basis of the weights and dimensions of the specimens as received.

TABLE IV. EFFECT ON PLASTICS OF IMMERSION

	Phenol-Formaldehyde Molded	Phenol-Formaldehyde Cast	Phenol-Formaldehyde Laminated	Urea-Formaldehyde Molded	Urea-Formaldehyde Laminated	Vinyl Chloride-Acetate Resin
30% Sulfuric acid	Surface roughened	None	Edges swollen	Surface roughened	Surface attacked	None
3% Sulfuric acid	Surface roughened	None	Edges swollen	Surface roughened	Surface attacked	None
10% Nitric acid	Surface roughened	None	Edges swollen	Surface roughened	Delaminated	None
10% Hydrochloric acid	Surface roughened	None	Edges swollen	Surface roughened	Delaminated	None
5% Acetic acid	None	None	Edges swollen	None	None	None
Oleic acid	None	None	None	None	None	None
10% Sodium hydroxide	Decomposed	Decomposed	Delaminated	None	Surface attacked	None
1% Sodium hydroxide	Surface roughened	Decomposed	Edges swollen	None	None	None
10% Ammonium hydroxide	Surface dulled	Discolored	Discolored; edges swollen	None	None	None
2% Sodium carbonate	None	Discolored	Discolored	None	None	None
10% Sodium chloride	None	None	Edges swollen	None	None	None
3% Hydrogen peroxide	None	Discolored	None	Surface dulled	Delaminated	None
Distilled water	None	None	None	None	None	None
50% Ethyl alcohol	None	None	None	None	None	None
95% Ethyl alcohol	None	None	None	None	None	None
Acetone	None	Softened	Blistered	None	None	Dissolved
Ethyl acetate	None	None	None	None	None	Decomposed
Ethylene chloride	None	None	None	None	None	Dissolved
Carbon tetrachloride	None	None	None	None	None	None
Toluene	None	None	None	None	None	Soft; rubbery
Gasoline	None	None	None	None	None	None

Test results and discussion

The changes produced in the weights and dimensions of the plastics specimens by immersion in the reagents for 7 days at 25 deg. C. are shown in Table II. It is possible by examination of the vertical columns to obtain a general picture of the resistance of a given plastic to the various types of chemicals. Likewise, by following across the table horizontally one can see the relative resistances of the various types of plastics to a given reagent. Thus, the top line of figures indicates that styrene and vinyl chloride-acetate resins are outstanding in their resistance to 30-percent sulfuric acid. Looking down the first column of figures, it is readily apparent that the phenolic molding composition containing wood flour is markedly attacked by 10-percent sodium hydroxide solution. Similar observations for the other chemicals and plastics can be readily made from the data in Table II. For those reagents involving aqueous solutions it is helpful to compare the values observed for immersion in water alone with those measured after immersion in the solutions.

The results obtained in gasoline cannot be taken as representative of the effect of aliphatic hydrocarbons on the plastics, as it is probable that some naphthenes and aromatic hydrocarbons were also present. For this reason, the subcommittee which prepared this method has under consideration a proposal to substitute a typical aliphatic hydrocarbon for gasoline in this test. Considerable variation in the action on some plastics of the three gasolines used in the tests reported in this paper was noted.

In examining the values for changes in thickness, it is important to remember that the measurements were made only to the nearest 0.001 in. and that changes of less than about 1 percent are not significant.

(*Please turn to next page*)

FOR 7 DAYS IN CHEMICAL REAGENTS AT 25 DEG. C.

Vinyl Butyral Resin	Methyl Methacrylate Resin	Styrene Resin Molded	Styrene Resin Cast	Cellulose Nitrate	Cellul Acetate	Ethyl-Cellulose No. 1	Ethyl-Cellulose No. 2	Cold-Molded Phenolic	Cold-Molded Bituminous	Casein Plastic
None	None	None	None	None	Crazed; softened	None	None	None	None	Rubbery
Cloudy	None	None	None	None	Swollen	None	None	None	None	Swollen; rubbery
Cloudy	None	None	None	None	Decomposed	None	None	None	None	Swollen; cracked
Cloudy	None	None	None	None	Decomposed	None	None	Cracked on drying	Cracked on drying	Swollen; cracked
Cloudy	None	None	None	None	Swollen	None	None	None	None	Rubbery; split
Tacky	None	None	None	None	None	Decomposed	Decomposed	None	None	None
None	None	None	None	Crazed	Decomposed	None	None	Decomposed	None	Decomposed
Slightly cloudy	None	None	None	Crazed	Surface attacked	None	None	Decomposed	None	Broken up
Opaque	None	Discolored	None	Crazed; discolored	Opaque; soft	None	Dye attacked	None	Surface attacked	Swollen; split
Slightly cloudy	None	None	None	None	Swollen	None	None	None	None	Swollen; rubbery
None	None	None	None	None	None	None	None	None	None	None
Cloudy	None	None	None	None	None	None	None	None	None	Swollen; rubbery
Cloudy	None	None	None	None	None	None	None	None	None	Swollen; rubbery
Swollen; rubbery	Slightly swollen	None	None	None	Partly dissolved	Swollen; cracked	Swollen; cracked	None	None	Swollen; rubbery
Dissolved	Surface attacked	None	None	Dissolved	Partly dissolved	Dissolved	Dissolved	None	None	None
Swollen; opaque	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	None	Broke in half	None
Decomposed	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	None	None	None
Decomposed	Dissolved	Dissolved	Dissolved	Partly dissolved	Soft; swollen	Dissolved	Dissolved	None	Cracked	None
Swollen; rubbery	Surface attacked	Dissolved	Dissolved	None	None	Dissolved	Dissolved	None	Cracked	None
Swollen; rubbery	Dissolved	Dissolved	Dissolved	Partly dissolved	None	Dissolved	Dissolved	None	Cracked	None
None	None	Partly dissolved	Tacky; bubbled	None	None	Swollen; cracked	Swollen; cracked	None	None	None

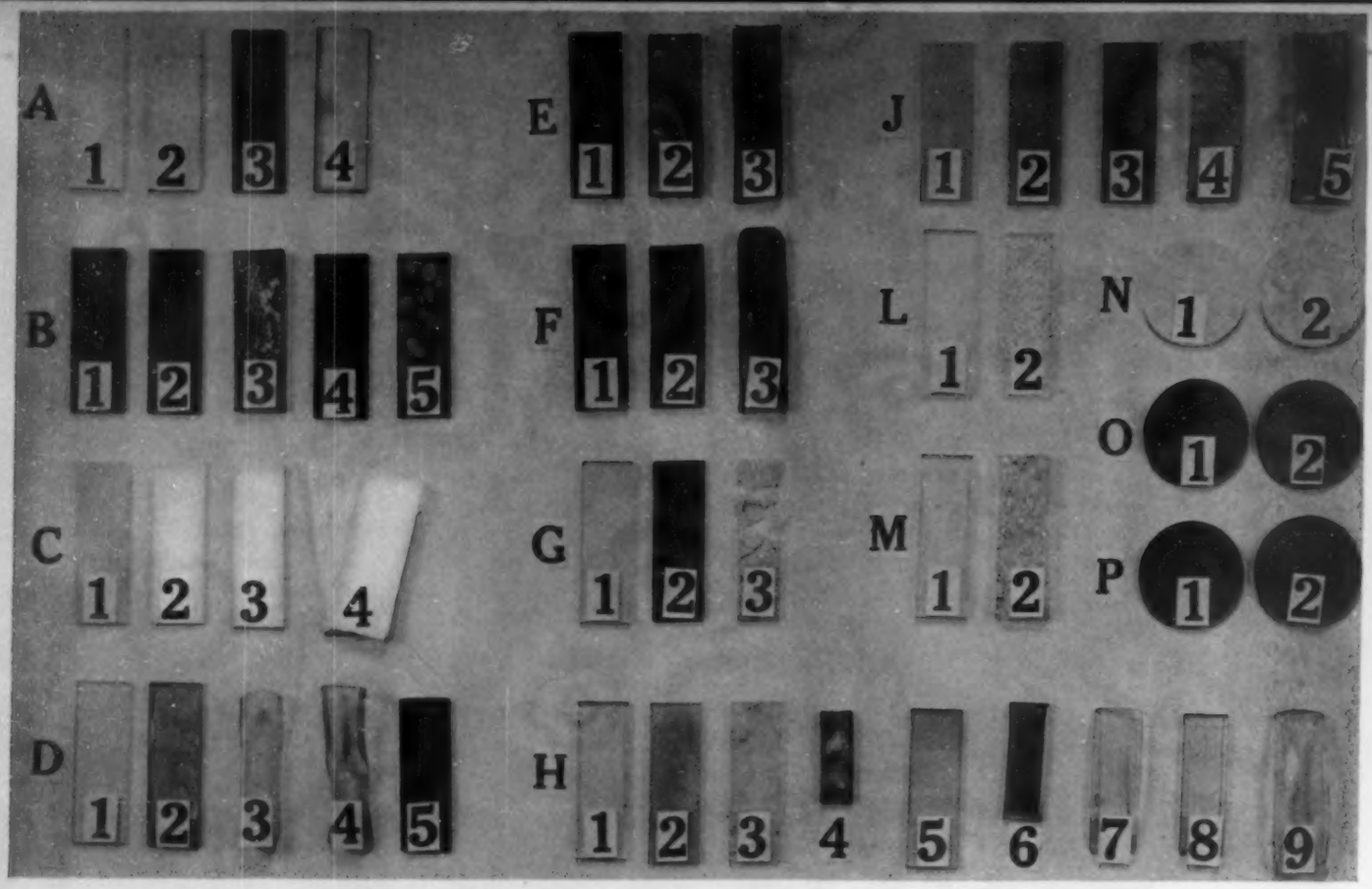


Fig. 1.—Appearance of various plastics after immersion for 7 days in chemical reagents at 25 deg. C.

A—Phenol-formaldehyde cast
1. Original
2. 10% Nitric acid
3. 1% Sodium hydroxide
4. 2% Sodium carbonate

B—Phenol-formaldehyde laminated
1. Original
2. 10% Hydrochloric acid
3. 10% Sodium hydroxide
4. 1% Sodium hydroxide
5. Acetone

C—Urea-formaldehyde laminated
1. Original
2. 30% Sulfuric acid
3. 10% Sodium hydroxide
4. 3% Hydrogen peroxide

D—Vinyl butyral resin
1. Original
2. Oleic acid
3. Acetone
4. Ethylene chloride
5. Carbon tetrachloride

E—Ethylcellulose No. 1
1. Original
2. 50% Ethyl alcohol
3. Gasoline

F—Ethylcellulose No. 2
1. Original
2. 50% Ethyl alcohol
3. Gasoline

G—Cellulose nitrate
1. Original
2. 10% Ammonia
3. Ethylene chloride

H—Cellulose acetate
1. Original
2. 30% Sulfuric acid
3. 10% Hydrochloric acid
4. 10% Sodium hydroxide
5. 1% Sodium hydroxide
6. 10% Ammonia
7. 50% Ethyl alcohol
8. 95% Ethyl alcohol
9. Ethylene chloride

J—Casein
1. Original
2. 30% Sulfuric acid
3. 10% Nitric acid
4. 10% Hydrochloric acid
5. 10% Ammonia

L—Methyl methacrylate
1. Original
2. Carbon tetrachloride

M—Polystyrene
1. Original
2. Gasoline

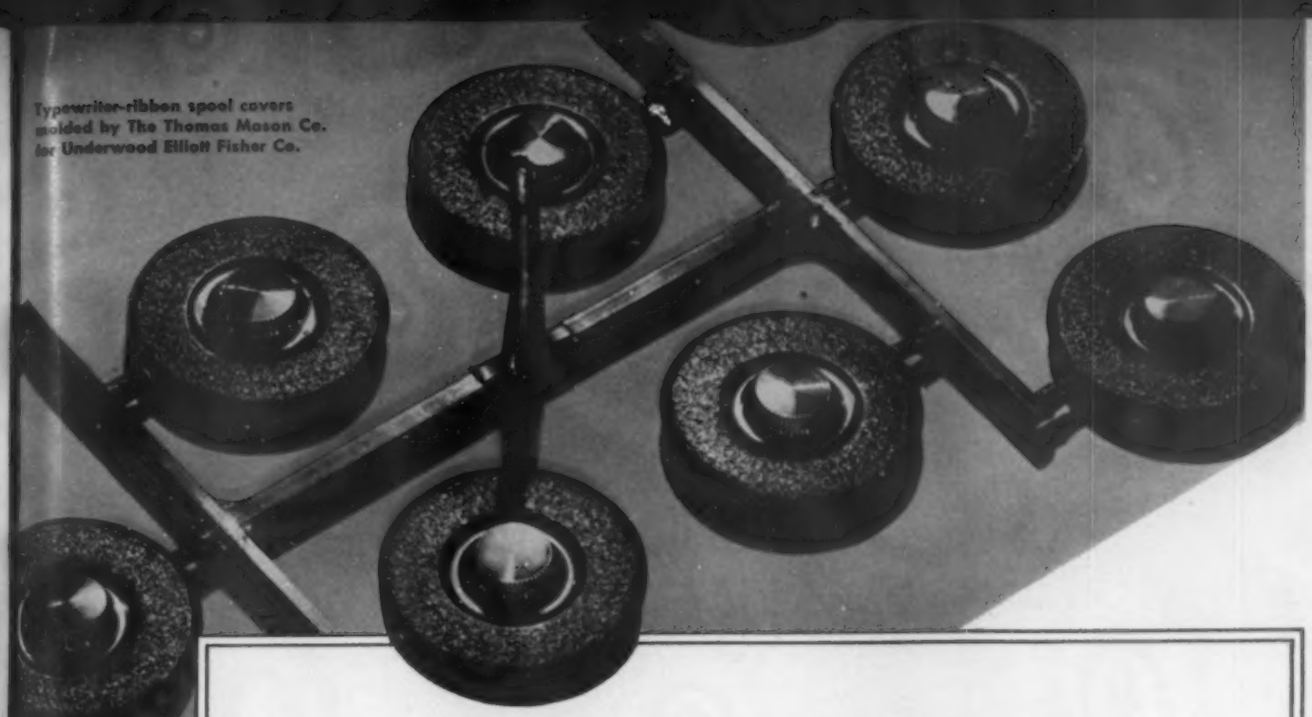
N—Urea-formaldehyde molded
1. Original
2. 10% Nitric acid

O—Cold-molded phenolic
1. Original
2. 1% Sodium hydroxide

P—Cold-molded bituminous
1. Original
2. Ethylene chloride

Data relating to the recovery of the original weights and dimensions by the specimens of plastics after removal from the chemical reagents are presented in Table III. The values indicate the percentage changes from the original condition of the specimens after they had been removed from the reagents and exposed for 4 weeks at 25 deg. C. and 50 percent relative humidity. In many instances negative values are observed which can be attributed to the removal of a portion of the plastic composition by the chemical reagent. This is particularly pronounced for cellulose acetate plastic from which plasticizers were apparently leached.

Comparison of the data in Tables II and III will reveal that for some materials the absorption of the chemical reagent over the 7-day period was nearly balanced by the removal of soluble constituents from the plastic. Thus, for cold-molded phenolic plastic the gain in weight during 7 days' immersion in a 5-percent solution of acetic acid was only 0.2 percent, but the weight of the plastic 28 days after removal from the reagent was 1.1 percent less than the original weight. Likewise, for cold-molded bituminous plastic the 7-day gain in weight in 3-percent sulfuric acid was only 0.09 percent, but the weight 28 days after removal from the reagent was 4.3 percent under the original weight. Hence, it is obvious that unless the weight is determined after reconditioning in air, a false impression may be gained regarding the (*Please turn to page 88*)



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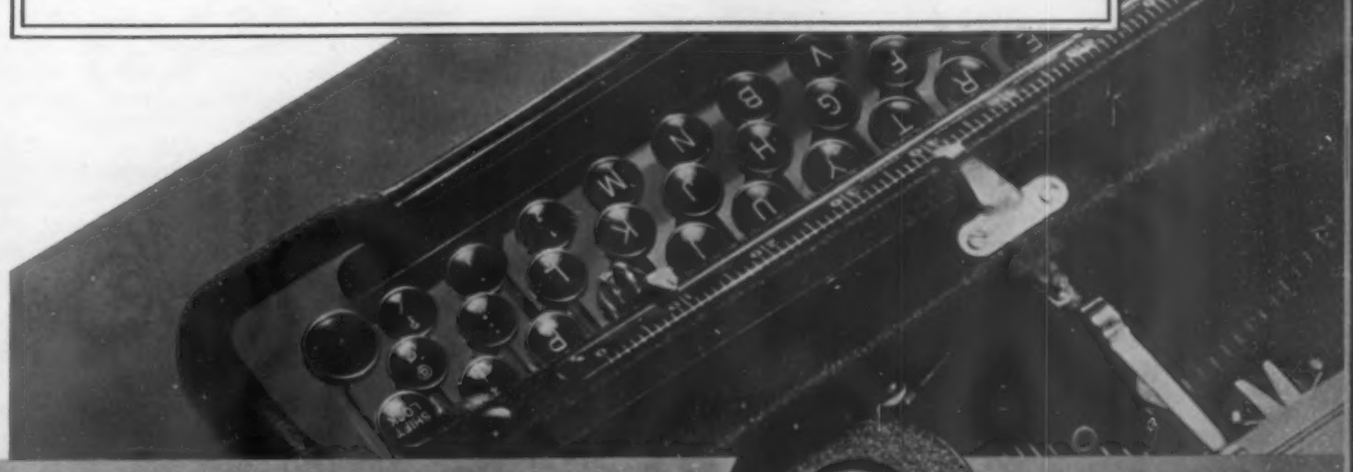
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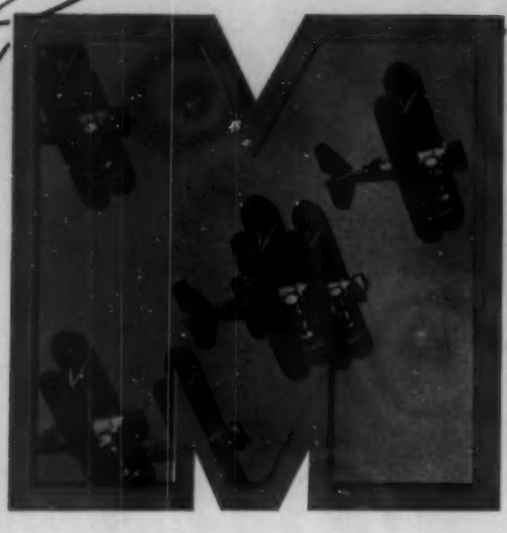
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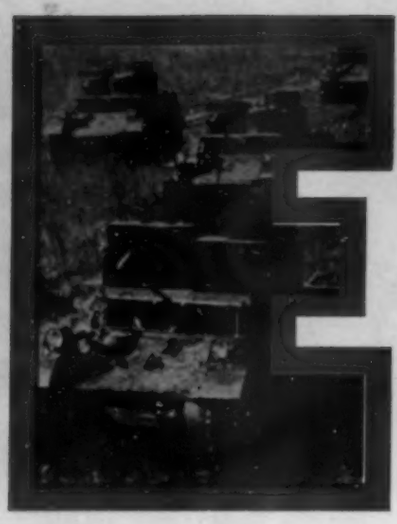
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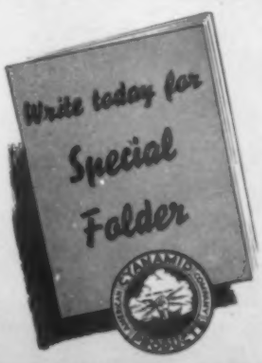
ELECTRICAL PROPERTIES

DIELECTRIC STRENGTH* (Short Time) 60 Cycles	
Volts/mil at 100° C.	391 (382-403)
Volts/mil at 25° C.	416 (384-424)
After Heating 8 hours at 300° F.	
Volts/mil at 100° C.	402-466 (2 values)
ARC RESISTANCE* (ASTM) Seconds	145 (142-148)
After Heating 8 hours at 300° F.	157 (146-168)
POWER FACTOR* (60 Cycles)	15.2% (14.9-15.4)
After Heating 12 hours at 270° F.	6.0%
DIELECTRIC CONSTANT* (60 Cycles)	11.7 (10.8-12.3)
After Heating 8 hours at 220° F.	9.7 (9.3-10.5)
LOSS FACTOR* (60 Cycles)	1.80
After Heating 8 hours at 220° F.	1.28

*Tests conducted by A.S.T.M. methods (indicated by *) on test pieces prepared at Stamford Laboratories of American Cyanamid Company. For all electrical tests, a 4" disc, .080" thick, was employed.*

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SPECIFIC GRAVITY	1.98
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FLEXURAL STRENGTH*	8,000 lb. per sq. in.
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WATER ABSORPTION* 48 hours. Water 25° C.	.10%
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A CYANAMID PLASTIC

Plastics from agricultural by-products*

by O. R. SWEENEY†, L. K. ARNOLD† and W. D. HARRIS†

The potentialities of the enormous tonnages of the annual farm crop residues as raw materials for the manufacture of plastics have stirred the imagination of scientist and layman alike. Efforts to utilize these wastes for the production of low-cost molding compositions have been chronicled in this magazine from Vol. 1 to date. Some of the agricultural products which have been investigated are soybeans, coffee beans, corn including the stalks and cobs, oat hulls, cottonseed hulls, bagasse, nut shells and wood wastes. These materials contain cellulosic, lignin and protein compounds and, in many instances, substances capable of yielding phenols and aldehydes can be converted into plastics by chemical treatment.

The bridging of the gap between successful development and molding of these materials in the laboratory and their economical production and utilization on a commercial scale has proved to be a difficult and time-consuming task. Many progressive firms in the plastics industry have attempted to solve this problem, and they have had the assistance of several Government agencies in this undertaking. In the meantime many synthetic plastics made from relatively high cost chemicals have passed from laboratory curiosities to become industrial materials of importance to our national economy.

The major obstacle to success with the natural products has apparently been their slower and less uniform flowing and curing properties as compared with those of the synthetic plastics. The cost of labor, molds and presses very quickly exceeds any saving in molding composition costs if the molding cycle is lengthened appreciably. Furthermore, cost comparisons have frequently been on the basis of raw material costs of the natural product versus the market price of the synthetic product. When the overhead costs of marketing and servicing are considered, the margin between the natural and synthetic products is reduced to an extent which makes molding qualities the deciding factor in the use of these two types of products in a competitive market.

Because of the present scarcity of chemicals required for the manufacture of certain synthetic resins, the outlook for the utilization of the natural products in plastics is more favorable than at any time in the past. A longer molding cycle is preferable to no molding cycle at all. Unfortunately, most of these natural plastics require small quantities of the scarce chemicals for their preparation. If this handicap can be overcome, the year 1942 should see some real progress in the industrial conversion of these agricultural residues into plastics. One of the pioneers in this field of chemical engineering has been Professor O. R. Sweeney of Iowa State College. An account of some of the work of Dr. Sweeney and his colleagues is presented in this article.—G. M. K.

IN THE highly competitive field of plastics manufacture, in order for a new product to have high possibilities of success it must have either outstanding qualities or an abundant and a relatively cheap source of raw material.

An abundant source of raw material is presented by agricultural wastes, or by-products, such as cornstalks, corncobs, oat hulls, cottonseed hulls, peanut hulls and various straws and stalks. There are available annually in excess of 400 million tons of these materials. If used at all, these agricultural wastes are inefficiently utilized. In fact, immense quantities are burned every year merely to get rid of them.

These wastes present several interesting possibilities in the plastics field. Since they are cellulosic materials they are possible starting points of cellulose nitrate, cellulose acetate and cellulose derivatives. Whether or not they will be used in this field is largely a matter of raw material and processing costs. Another constituent of these materials is lignin, which is also a potential raw material for plastics. The third possibility is the high pentosan content which may be converted into furfural to be used in the phenolic plastics. This, of course, is now done commercially with furfural derived from oat hulls. Furfural can also be produced from other agricultural wastes. The raw material used is determined by such practical considerations as segregated raw material cost, yield and processing costs.

Since it is an established fact that furfural can be readily produced from these pentosan-containing materials by suitable treatment with acid, and that it can be used with phenol in the production of a plastic, it was thought possible that the pentosan material could be

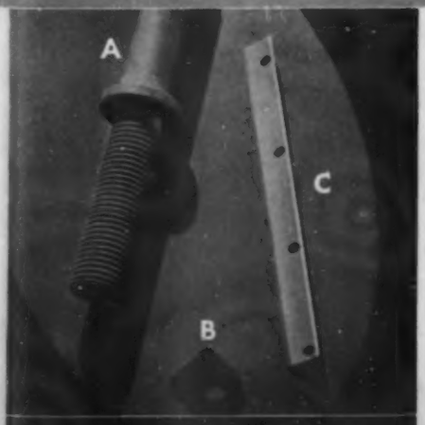
1—The operator (below) is molding plastic samples from agricultural by-products in an electrically heated press



* The research work described in this article was carried on as part of the Agricultural Waste Research program of the Engineering Experiment Station, Iowa State College. Two patents (Sweeney, O. R., Moldable phenolic pentosan material, U. S. Pats. 1,797,559 and 1,797,593) March 24, 1931, covering part of this work have been issued and assigned to the college.

† Head of Chemical Engineering Department, Research Associate Professor of Chemical Engineering Experiment Station, Former Instructor of Chemical Engineering Department, respectively, all of Iowa State College, Ames, Iowa.

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treated with acid and phenol to produce the plastic product without first separating furfural. Such a procedure would leave the cellulose in the product as a filler. As early as 1922 it was found experimentally in this laboratory that a plastic material could be produced in this manner.

A little consideration, however, will show that the chemistry of what occurs is not as simple as outlined because the acid and phenol may react with constituents other than the pentosans. Experiments were made using the constituents of these agricultural wastes separately—namely, cellulose, lignin and pentosans.

Reactions with cellulose

The reaction of pure cellulose and phenol with sulfuric acid as a catalyst was studied by heating together 100 grams of phenol, 35 grams of filter paper and 10 grams of sulfuric acid until a complete reaction was secured and the temperature had risen to 200 deg. C. The cellulose went into solution between 140 deg. and 160 deg. C., producing a black, viscous liquid which on further heating lost some water and unreacted phenol. When cooled the product was a hard, black resin. It was found that 6 parts of phenol were required for a complete reaction with 5 parts of cellulose. When a saturated solution of zinc chloride was substituted for the sulfuric acid, a similar product was produced. Cresol, when substituted for the phenol, reacted more vigorously but produced a like product. These products could be molded and were very similar to the material produced from corncobs.

The reaction of sulfuric acid on cellulose was not studied since it is well known that concentrated acid breaks down the cellulose, and that dilute acid causes hydrolysis, yielding various products such as modified cellulose, dextrins, maltose and dextrose.

Reactions with lignin

When phenol and corncob lignin were heated together, they failed to react. When 1 part of sulfuric acid was added to 5 parts corncob lignin and 10 parts of phenol and heated at 120 deg. C., they reacted to form a black, tarry liquid which, on prolonged heating, became a brittle solid. With an alkaline catalyst, lignin and furfural reacted to give a resin. The best proportions tried for this experiment were lignin 12 parts, furfural 8 parts and lime 1.2 parts.

Reactions with pentosans

It is well known that pentosans, when heated with dilute hydrochloric or sulfuric acid, hydrolyze to the corresponding pentoses. The intermediate products of this reaction are not known but it is possible that there may be a series analogous to those produced from cellulose under similar conditions. Continued heating with acid produces furfural. Furfural reacts with phenol to give a resin and also forms a hard, black, resinous material with sulfuric or hydrochloric acid.

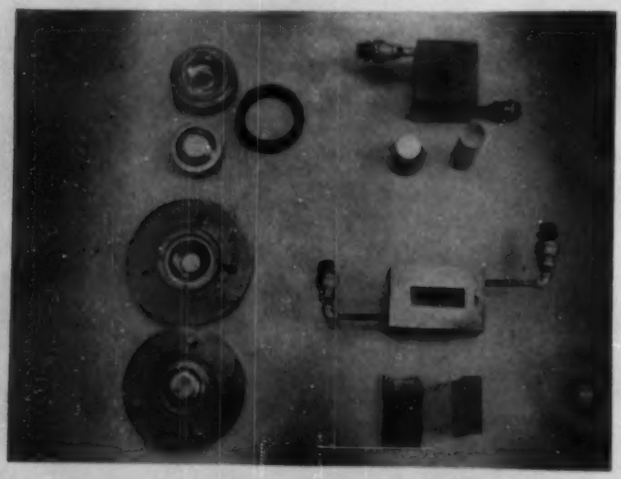
Reactions with agricultural products

It is reasonable to assume that any or all of the reactions discussed may occur when agricultural waste materials such as corncobs, oat hulls or cornstalks are heated with phenol or cresol, and sulfuric or hydrochloric acid. It is impossible to state the relative importance of each of these reactions in the resultant mass, but the resinous product produced is apparently a mixture of the various products discussed.

Preliminary studies using corncobs indicated that good results could be secured using the following procedure: 10 parts of ground corncobs, 5 parts of phenol or cresol, and 1 part hydrochloric acid (sp. gr. 1.18) were mixed together and heated at 100 deg. C. for 3 to 6 hours. The product, which was gummy at first, was dried at room temperature until hard, ground to a powder in a ball mill, and pressed into a disk in a steel mold under 20 tons per sq. in. pressure. The molding time varied from 10 seconds to several minutes. After molding, the disks were baked in an oven beginning at 70 deg. C. and slowly increasing the temperature to 125 deg. C. The product was hard, black and shiny.

It was impossible to secure satisfactory mixing without using an excess of phenol or adding some diluent. After experimenting with several organic solvents it was finally decided that water was the most suitable diluent. Studies were made of the best proportions of cobs, phenol and acid by systematically varying the relative amounts used. Cooking under atmospheric pressure, refluxing and cook (*Please turn to page 90*)

2—Typical molds for these plastic parts and 3—Banbury mixer, both of which are used in experimental work.



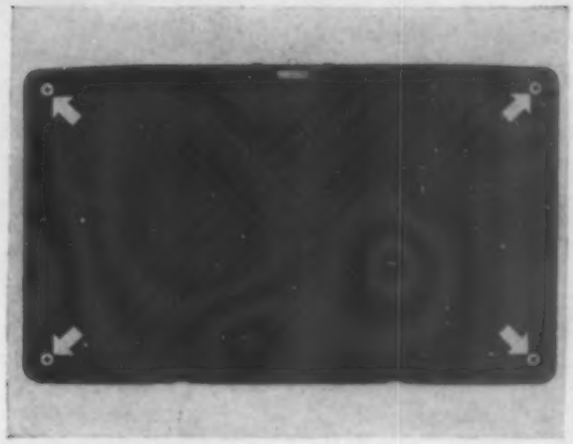
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General

PRESENT STATUS OF SYNTHETIC RUBBER. E. R. Bridgwater. Ind. Eng. Chem. *33*, 1342–6 (Nov. 1941). By the end of 1942 plant facilities for producing 1600 long tons of neoprene and 4200 tons of butadiene rubbers per month will be available. Butyl rubber capacity will be about 400 tons per month. Plants for making polysulfide rubbers can be built relatively quickly as needed. Capacity for producing polyvinyl chlorides will be 900 long tons of unplasticized resin per month which is equivalent to about 1500 tons of plasticized material. This total amount of synthetic rubbers will be less than 10 percent of the quantity of the natural product currently consumed. Contracts for the erection of three butadiene plants and three styrene plants to supply raw materials for the synthetic rubber plants are under negotiation.

PLASTICS AND THE ARCHITECT. T. W. Kennedy. Plastics *5*, 188–9 (Oct. 1941). The use of plastics in the prefabricated houses of the future is discussed. Employment of thermosetting and thermoplastic materials for wall paneling, window frames, stairs, doors, roof covering, etc., is visualized.

BLACKOUT PREPARATIONS IN THE UNITED STATES. H. E. Millson. A.C.S. News Ed. *19*, 1266–72 (Nov. 25, 1941). Fluorescent and phosphorescent plastic products in defense applications are reviewed.

Materials and Manufacture

FORMALDEHYDE: PROPERTIES, ANALYSIS AND MANUFACTURE. H. W. Homer. J. Soc. Chem. Ind. *60*, 213–8 (Aug. 1941). See abstract of this article on page 66 in the Aug. 1941 issue of MODERN PLASTICS.

Molding and Fabricating

THE MOLDING OF THERMOSETTING MATERIALS. P. Grodzinski. British Plastics *13*, 103–5, 124 (Sept. 1941). This is a contribution to the problem of calculating the optimum number of impressions when molding thermosetting materials. Graphs to facilitate the calculations are included.

Applications

PLASTIC BEARINGS AND SLIDING SURFACES IN MACHINES. Plastics *5*, 183–4 (Sept. 1941); 205–8 (Oct. 1941). Fundamental limitations of plastic bearings are discussed. Successful trends in the development of plastic bearings for railway rolling stock are discussed, although such application on an extended scale is still remote. Data on the performance of plastic bearings in various spheres of industrial application, including cranes, dredgers, and hydraulic presses, are presented in tables.

PLASTICS APPLIED TO AIRPLANE STRUCTURES. C. F. Marschner. Mech. Eng. *63*, 787–90 (Nov. 1941). Materials, manufacturing requirements and procedures, and potential applications of plastics in aircraft construction are considered. Primary structures include spars, skin, ribs, seats and flooring, control surfaces, and propeller cuffs and spinners. Secondary structures listed are leading-edge assemblies, brackets, wing tips, ducting and cowling, and leakproof fuel tanks. Nonstructural parts mentioned are fairing, cabinets, paneling, trim, access doors, junction boxes and conduit. Miscellaneous plastic items used at present in aircraft include windows, windshields, knobs, trim tabs, and pulleys.

THE TWIN-ENGINED 4-PLACE "LANGLEY." Aero Digest *39*, 143 (Nov. 1941). Thin strips of resin-treated mahogany veneers are molded to form an integral structure and skin of an airplane by the Langley Aircraft Corp. Specifications for the various features of the airplane are set forth.

MAKING A MODERN AIRSCREW. Plastics *5*, 190–2 (Oct. 1941). The various steps in the manufacture of a propeller from wood using resinous impregnating and bonding agents are described and illustrated. Propellers made of these materials are said to have a maximum working life of over 3000 flying hours. Fan blades for industrial cooling systems are also being made of the same materials with a spread up to 24 feet.

THE BOAT WITHOUT A NAIL. Plastics *5*, 196–7, 204 (Oct. 1941). The autoclave rubber-bag procedure for molding round bilge boats with compound curves using mahogany veneers and phenolic resin is described.

Properties and Testing

INFRARED SPECTRA OF RUBBER AND HIGH POLYMERS. W. C. Sears. J. App. Physics *12*, 35–40 (Jan. 1941). The transmission spectra of thin films of the following materials were measured for the wave lengths of 2.2 and 14.8 microns: crude rubber, soft and hard vulcanized rubber, Thermoprene (cyclorubber), polyvinyl chloride, neoprene (polychlorobutadiene), and Pliofilm (rubber hydrochloride).

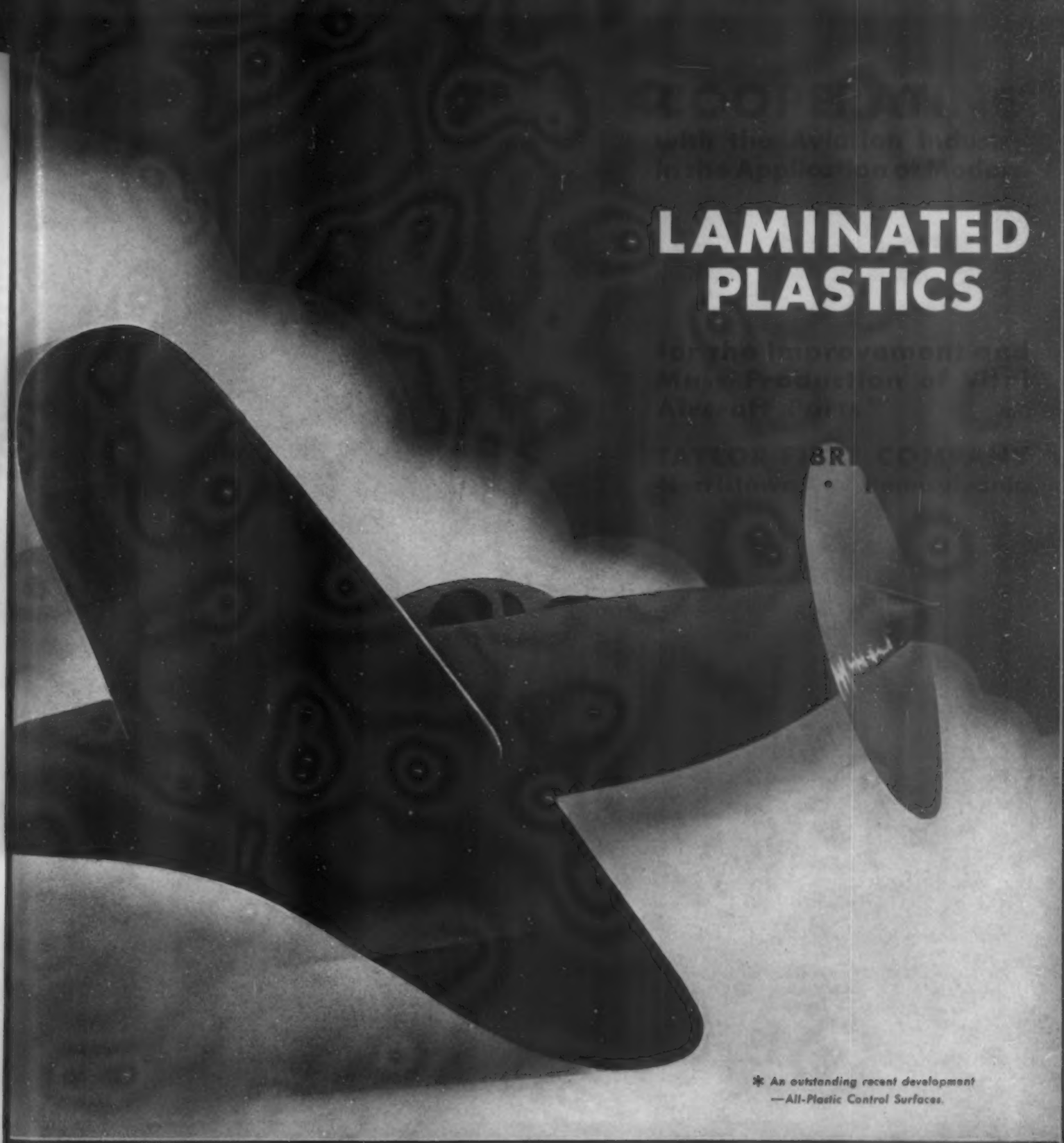
DIELECTRIC CONSTANT AND POWER FACTOR OF KOROSEAL AT RADIO FREQUENCIES. O. R. Fonts. J. App. Physics *12*, 21–2 (Jan. 1941).

DIELECTRIC PROPERTIES OF EXPERIMENTAL RESIN - PAPER BOARDS. L. Hartshorn, E. Rushton, and N. J. L. Megson. Electrician *127*, 46–7 (July 25, 1941). Electrical properties of composite boards made by impregnating paper sheets with acetone solutions of phenol-formaldehyde resins, removing solvent, and bonding under heat and pressure, are reported. The properties of the pure resins had previously been investigated.

WORKING-RANGE FLOW PROPERTIES OF THERMOPLASTICS. F. E. Wiley. Ind. Eng. Chem. *33*, 1377–80 (Nov. 1941). The coefficient of viscous traction of a thin plate test strip is measured under conditions of high temperatures and low stresses. The viscosity of the plastic is calculated and a viscosity-temperature chart obtained. Flow characteristics of thermoplastics determined by this method can be correlated with those obtained on the Bakelite-Olsen flow apparatus.

NEW INSTRUMENT FOR RHEOLOGICAL STUDIES OF PLASTIC SUBSTANCES. C. R. Bailey. Ind. and Eng. Chem., Analytical Ed. *13*, 173–7 (Mar. 15, 1941). An instrument for the quantitative evaluation of the proportional limit, yield strength and ultimate shear strength of plastics is described.

SOME RELATIONS OF FLOW AND PHYSICAL PROPERTIES WITH FORMULATION IN CELLULOSE ACETATE PLASTICS. W. E. Gloor. J. App. Physics *12*, 420–5 (May 1941). Results of Rockwell hardness, elastic modulus, impact strength and water absorption tests of cellulose acetates of ordinary and high acetyl types, plasticized with dimethyl phthalate, diethyl phthalate, triphenyl phosphate, methyl phthalyl ethyl glycolate, and mixed *o*- and *p*-toluenesulfonamide, are reported. No general relation was found between flow properties at molding temperatures and physical properties at room temperatures.



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ELECTROFORMING MOLDS. Andrew C. Dunn. U. S. 2,258,579, Oct. 7. Binding molds together with plastic, electroplating their exposed surfaces and the plastic surfaces between the molds to form a single electroplate reinforcing the plate with plaster, and removing the plastic from the molds.

DIP MOLDING. A. Boecler and K. Bratring (to Neocell Products Corp.). U. S. 2,258,642, Oct. 14. A machine for continuous production of shaped articles by dipping molds in a solution of a plastic.

OLEFIN RESINS. F. E. Frey and L. H. Fitch, Jr. (to Phillips Petroleum Co.). U. S. 2,258,702, Oct. 14. Producing resinous heteropolymers of olefins and sulphur dioxide by reaction in presence of a cuprous salt.

COATED GLASS. C. M. Langkammerer (to E. I. du Pont de Nemours and Co.). U. S. 2,258,708, Oct. 14. Highly waterproof films on glass have an alkyd resin undercoater and a baked phenolic resin finish coat.

SAFETY GLASS. J. G. McNally (to Eastman Kodak Co.). U. S. 2,258,991, Oct. 14. Safety glass with high resistance to bending and twisting as well as to shattering has a triple interlayer of methyl acrylate resin between two cellulose acetate sheets.

PHOTOGRAPHIC FILM. G. F. Nadeau (to Eastman Kodak Co.). U. S. 2,258,997, Oct. 14. Flexible film which is free from embrittlement has a cellulose triacetate base faced first with nitrocellulose, then with hydrolyzed cellulose acetate-propionate and finally with mixed hardened gelatin and nitrocellulose to which the emulsion is applied.

PHOTOGRAPHIC FILM. R. H. Talbot (to Eastman Kodak Co.). U. S. 2,259,009, Oct. 14. An abrasion-resisting coating on developed photographic film comprises cellulose acetate-phthalate.

TEMPLE BOWS. Ernest A. Ring (one-half to F. M. Blakeney). U. S. 2,259,082, Oct. 14. Fine wire temple bows for spectacles are coated with a strongly compacted covering of polyvinyl acetal resin.

BAKING LACQUER. J. B. Rust (to Ellis-Foster Co.). U. S. 2,259,085, Oct. 14. A resin for baked finishes is made by condensing urea, biuret and a phenol with formaldehyde.

CHLOROPRENE POLYMERS. H. W. Walker (to E. I. du Pont de Nemours and Co.). U. S. 2,259,122, Oct. 14. Thermosetting plastic chloroprene polymers contain organic sulphur compounds as stabilizers.

RUBBER-LIKE RESINS. J. J. Russell (to General Electric Co.). U. S. 2,259,141, Oct. 14. Plasticizing vinyl chloride resins with tetrahydrofuryl adipate or higher homologs thereof.

ANION EXCHANGE RESIN. J. R. Little (to U. S. Rubber Co.). U. S. 2,259,169, Oct. 14. Treating water with a resin formed from a ketone, an aldehyde and a polyalkylene polyamine, for selective sorption of impurities from the water.

FOIL. S. D. Gehman (to Wingfoot Corp.). U. S. 2,259,339, Oct. 14. Forming thin foils from a blend of rubber hydrochloride, and balata hydrochloride.

POLYMERIZATION. F. K. Schoenfeld and W. L. Semon (to B. F. Goodrich Co.). U. S. 2,259,180, Oct. 14. Polymerizing a low-boiling monomer at temperatures above its boiling point by dispersing the monomer in a liquid and passing it through an open reactor in which the hydraulic pressure exceeds the vapor pressure of the monomer.

EXTRUSION PRESS. V. S. Shaw and W. Ernst (to Hydraulic Press Corp.). U. S. 2,259,181, Oct. 14. A molding press in which a plastic is injected into a pair of cooperating dies under hydraulic pressure.

GOLF BALL COVERS. J. A. Merrill (to Wingfoot Corp.). U. S. 2,259,348–9, Oct. 14. Forming golf ball covers from rubber hydrochloride and a rubber derivative formed by condensation; and dispersing soft rubber powder in a rubber derivative for golf ball covers.

RUBBER HYDROCHLORIDE FOILS. H. J. Osterhof; L. B. Sebrell; F. J. Young (to Wingfoot Corp.). U. S. 2,259,352; 2,259,355; 2,259,362, Oct. 14. Forming clear rubber hydrochloride films by rapid evaporation from a cast film; or by evaporation in a hot air blast; and forming laminated stretched sheets from rubber hydrochloride foils on hot rolls.

BASE EXCHANGE RESINS. G. Caro, A. Rieche, K. Rudolph and H. Wassenegger. U. S. 2,259,455, Oct. 21. Condensing resorcinol, salicylic acid or phenolsulphonic acid with formaldehyde and a lignin sulphonate to form a resin for use in water purification.

HIGH MELTING CELLULOSE ESTER. C. L. Fletcher (to Eastman Kodak Co.). U. S. 2,259,462, Oct. 21. Esterifying cellulose with a lower aliphatic acid and partially hydrolyzing the product to form a stable high-melting ester.

ELASTIC RESINS. Helmut Jacobi and Walter Flemming. U. S. 2,259,470, Oct. 21. Heating allyl chloride with a water-soluble polysulphide to form rubber-like resins.

ADHESIVE. J. E. Robinson (to American Can Co.). U. S. 2,259,490, Oct. 21. An adhesive cement for fibrous surfaces is made of polyvinyl acetate and dammar resin.

COLD SEALING ADHESIVE. Curt Schulein (to Taccalin Chemical Corp.). U. S. 2,259,664, Oct. 21. Compounding a cellulose ester or ether with casein or dextrin and formaldehyde to form an adhesive.

CYCLOPENTADIENE RESINS. F. J. Soday (to United Gas Improvement Co.). U. S. 2,259,496–7, Oct. 21. Interpolymerizing partially polymerized cyclopentadiene with monomeric styrene; and with substituted methylstyrenes, to form resins.



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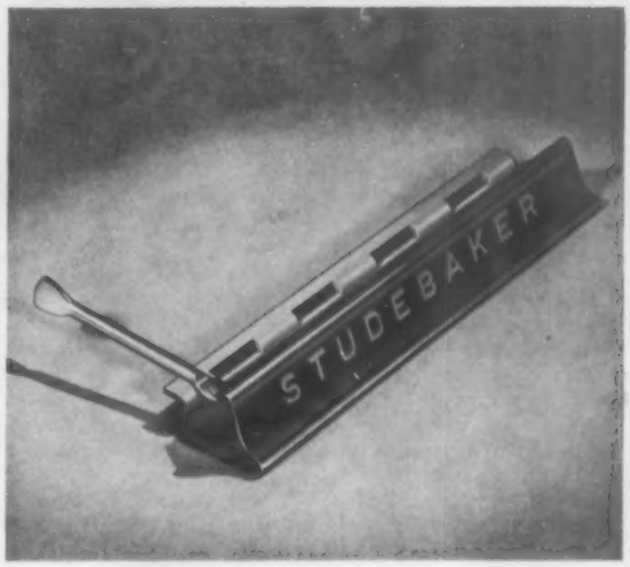
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A.S.M.E. Mechanical Catalog and Directory

The American Society of Mechanical Engineers, 29 West 39th St., New York, N. Y., 1942 537 pages

As is its custom every October, the American Society of Mechanical Engineers has issued its annual catalog and directory to the membership and mechanical profession at large.

The A.S.M.E. book might be described as a collective catalog with a classified listing of the products used in the field which it serves. There is also a practically complete list of the manufacturers of these products. Four sections comprise the volume: Catalogs, Directory, Trade Names and A.S.M.E. Publications.

In the section devoted to catalogs there are descriptions of hundreds of items used by the industry in manufacturing its products and maintaining its plants. The directory section indicates the source of equipment, machinery and supplies used by the mechanical engineer. Trade name section is a quick reference to trade names. They are listed alphabetically and supplied to the publisher by firms who pay for their listing. A.S.M.E. publications section is a comprehensive insert catalog of 16 pages which gives information on A.S.M.E. codes, standards, periodicals and other publications of the society. H. S.

★ A BRIEF HISTORY OF NYLON IS CONTAINED IN A 16-page booklet recently issued by Plastics Dept., E. I. du Pont de Nemours, Inc., Arlington, N. J., entitled, "Industrial Brush Bristles Made of Du Pont Nylon." The booklet reviews nylon, outlines its advantages, reports on its use in the brewery, textile, dry-cleaning, dairy, electroplating and other industries, as well as listing its general physical and chemical properties.

★ A NEW LINE OF DRUM CONTROLLERS FOR SMALL cranes and hoists is announced by Cutler-Hammer, Inc., Milwaukee, Wis., pioneer electrical manufacturers. Small and compact in size, these new drums have several features of outstanding interest. A rope operating lever, embodying a new equalized torque principle, entirely eliminates cumbersome sheave wheel, rope guard and external return spring, and provides smooth, easy operation even when the rope is pulled at an angle.

★ MASON-NEILAN REGULATOR CO., 1190 ADAMS St., Boston, Mass., has just released its new general Catalog No. 41, which describes many standard items in the Masoneilan line.

★ SIXTH EDITION OF A FORTY-EIGHT PAGE BOOKlet giving in detail simple and practical methods of analyzing plating solutions has been published by the Hanson-Van Winkle-Munning Co., Matawan, N. J., manufacturer of electroplating equipment. This work has now been in circulation since 1930 and has become one of the standard textbooks in its field. The methods recommended are simple and practical in character, and can be applied by men without extensive chemical training. A number of new features appear in this edition. The contents of the book include descriptions of the principles involved in analysis, the use of apparatus, the method of sampling a plating solution and step-by-step methods for analysis of solutions.

★ HELPFUL INFORMATION FOR HYDRAULIC ENGIneers and others fills "Engineering Tables," a 12-page manual issued by Watson-Stillman Co., Roselle, N. J. Among subjects discussed are: capacities of hydraulic rams, discharge of water for circular straight edge orifices, medium carbon seamless steel pipe data, decimal equivalents, circumferences and areas of circles, metric conversion tables, strengths of materials and useful hydraulic formulae.

★ DOWINGTON MANUFACTURING CO., HUBER Pump Div., Philadelphia, Pa., has brought out a "Squeegee Type" pump. It consists of a flexible rubber tube which is alternately squeezed and released so that the liquid or gas is actually breathed into and out of the tube. The company briefly describes its workings, with various illustrations in color, in an attractive folder issued recently.

★ CATALOG NO. 42 HAS JUST BEEN ISSUED BY GITS Molding Corp., Chicago, Ill., under the title, "Gits Plastic Products." There are 14 pages of illustrated text dealing with its line of plastic gifts, novelties and specialties.

★ LOALIN, A HANDY LITTLE BOOKLET PUBLISHED by Catalin Corp., 1 Park Ave., New York City, tells the molder what he may expect of this "perfected polystyrene." There are 12 subjects discussed. They are molding qualities, specific gravity, color range, clarity, water absorption, electrical properties, chemical properties, heat insulation, dimensional stability, effect of age and weather, and availability. A table on the general properties of Loalin will be found on the last page.

★ BULLETINS NOS. 31, 72, 73, 74, 51, 81 AND 83 HAVE just been issued by the Despatch Oven Co., Minneapolis, Minn. They fully describe the various products manufactured by the organization. Text is illustrated by photographs and charts. Particularly interesting to the plastics industry are Bulletin 74 on indirect air heaters for ovens, dryers and space heating and Bulletin 31 on streamline core baking and mold drying.

★ TWO IMPORTANT DEFENSE HANDBOOKS, ONE summarizing all price and priority regulations to date and the other listing products subject to export control, have recently been published by the N. Y. Journal of Commerce. All government and voluntary price controls and priorities are brought up to date in the Price and Priority Digest. In addition to giving the status of nearly 200 commodities and commodity groups, prospects for civilian allotments are also reviewed for quick reference on part of the purchasing executive.

★ NEVILLE COAL TAR SOLVENTS IS A HANDY 39-page booklet which informs the reader of the properties and a number of important applications of resins, solvents and other coal by-products manufactured by the Neville Co., Pittsburgh, Pa.

★ A FOLDER LISTING THEIR LINE OF BALL AND pebble mills, mixers, agitators and blenders has been issued by the process equipment division of H. K. Porter Co., Inc., Pittsburgh. Each piece of pictured equipment is briefly described.

★ "THE TOCOL LINE" IS THE NAME OF A NEW BOOKlet just issued by Protective Coatings, Inc., Detroit, Mich. This is a limited edition containing complete information about all items in the Tocol line of protective coatings.

★ A CARDBOARD FOLDER CONTAINING SIX ACTUAL samples of G-E varnished tubings, and full information about them, has been published by the insulating materials section of the General Electric appliance and merchandise department, Bridgeport, Conn. When opened, the folder becomes a reference card which may be fastened to the wall or desk.



You may search in vain through a long catalog of plastics for a combination of certain physical properties . . . until you come to hard rubber. In many respects hard rubber is totally unlike other moldable materials and for certain industrial applications stands alone.

Not the least of its advantages is the fact that we are now fabricating unit moldings up to 10 ft. x 3 ft. x 28 in. in Ace Hard Rubber.

American Hard Rubber Company
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111 West Washington St.
Chicago, Ill.
Akron, Ohio

POSSIBLY YOU HAVE A PROBLEM WHERE

Only ACE HARD RUBBER will do!

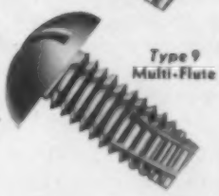
SOLVING PLASTIC FASTENING PROBLEMS!



SHAKEPROOF
Thread-Cutting Screws







With the aid of polarized light, SHAKEPROOF Engineers have carefully studied the strains and stresses which are set up by driving screws into plastic materials. From the information gained, they have been able to develop specially designed types of Thread-Cutting Screws for plastics, which function efficiently without danger of fracturing. These Engineers are in a position to be of real help to you in the solving of your plastic fastening problems, and they will gladly study your problem without cost or obligation!

SEND FOR SAMPLES!

See how easily you can eliminate separate tapping operations or threaded inserts. Send for free testing samples of these screws that actually cut their own threads. State the type desired (2, 9 or 25) and samples will be forwarded immediately—write us today!

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Distributor of Shakeproof Products Manufactured by ILLINOIS TOOL WORKS
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Plants at Chicago and Elgin, Illinois
In Canada: Canada Illinois Tools, Ltd., Toronto, Ontario
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SHAKEPROOF PRODUCTS INCLUDE THE FOLLOWING:
SEMS Fastener Units . . . Lock Washers . . . Locking and Plain Terminals . . . Thread-Cutting Screws . . . Locking Screws . . . Spring Washers . . . Radio and Instrument Gears . . . Engineered Shakeproof Parts . . . Special Stampings

Machinery and Equipment



★ FOR PRODUCTION OF AIRCRAFT AND NAVY WIRE and cable new large-capacity continuous extruding machines for thermoplastics compounds (above) have been announced by National Erie Corp. New units of this type are available with plasticizing cylinders from 3½ to 12 in. diameter and equipped with corrosion-resisting linings claimed to be of extraordinary hardness. Cylinders are completely jacketed for high temperature operation, and are baffled to provide "progressive heating" of the material passing through the processing chamber. Peripheries of stock screws, specially developed for plastics, are protected against wear by the application of a new hard surfacing alloy which, it is said, does not check or crack when subjected to wide variations in temperature. Improved axial type extruding heads suitable for tubes or straight extruding of miscellaneous commercial shapes are standard equipment. For insulating service there is a choice of screwed, bolted or hinged crossfeed head constructions with adequate provisions for cleaning and adjustment and maintenance of precision settings required on this type of operation. Machines are driven through enclosed transmissions with all gearing straddle mounted between heavy duty roller bearings and automatically lubricated.

★ OPERATED ENTIRELY BY FOOT CONTROL, STUDEbaker Machine Co.'s new hydraulic vise leaves a man's two hands free for setting up and removing his work. Mounted in a pedestal on the floor, a foot pedal pump arrangement connects with the vise proper by means of a steel tube carrying the hydraulic fluid to the ram behind the back jaw, and moving it forward. Front jaw is stationary. Stepping on one pedal brings the vise jaw in contact with the work. Second pedal applies pressure up to 5 tons, and third releases the jaw. The vise comes in 2 sizes—5 in. and 7⅓ in. width between jaws—is of semi-steel, and will mount on any bench, portable stand, or vertically on wall or post. The unit is self-sufficient and needs no outside power. Designed for speed and for handling heavy work on production line, in tool room and in ordinary vise work, the Studebaker unit will press, punch, bend, cut, straighten, test and stamp.

★ THE SYNTRON CO. HAS JUST ADDED TWO NEW models of electromagnetic vibratory feeder conveyors to its line. The Model F-4 has a capacity of up to 100 tons per hour of material such as crushed rock, and carries feeder pans as wide as 36 inches and as long as 60 inches in size. The larger capacity Model F-5 will handle as much as 500 tons per hour of such material and can be supplied with troughs as wide as 48 in. and from 60 in. to 96 in. long.

★ TO STEP UP PRODUCTION ON SMALL-HOLE DRILLing and tapping operations, a series of two-, three- and four-spindle drilling machines has been introduced by Atlas Press Co. As in all this company's heavy duty drill presses, the drilling heads of these machines incorporate the ball-bearing equipped floating drive, which transmits turning power to the spindle alone, and is entirely separate from the drill press spindle. Each drilling head is equipped with its own motor mounting and a new type of positioning control with crank handle. Turning the handle raises or lowers the drill head on the support column. A large precision-ground oil table provides ample room for movement of heavy jigs, fixtures and parts.



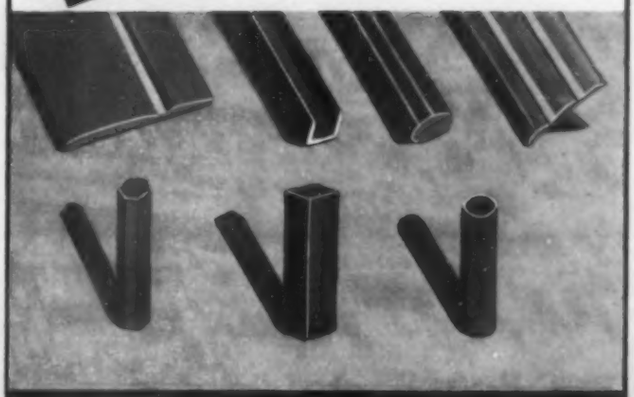
★ A NEW, LIGHTWEIGHT SANDBLAST GUN SUITABLE for decorative and sign work (above) is manufactured by the Paasche Airbrush Co. It is ideal for creating striking permanent signs in plastics. The sandblasted plastics are especially effective when used for directional signs and directory panels. The gun is 5¾ in. long and weighs only 14 oz. with pint abrasive container. It operates on ¼ h.p. air-compressor on larger containers. The gun will handle such materials as aluminum oxide, silicon carbide, steel grit, etc., of 30 to 70 screen mesh.

EXTRUDED
PLASTIK-ON-EDGE
SHAPES

CUSTOMIZED EXTRUDED SHAPES DESIGNED TO MEET YOUR SPECIFIC REQUIREMENTS

If it's a plastic EXTRUDED shape—

We can supply it!



The PLASTIKON Co.
100 McPHAIL STREET
BALTIMORE MARYLAND



BALANCE

BEYOND THE VERDICT OF THE SCALE

Scientific equipment alone can never compensate for the human equation: skill, experience and the will to permit no compromise with excellence • Only the combination of *all* can deliver the balance assured when you

Specify HEYDEN

Formaldehyde

PARAFORMALDEHYDE
HEXAMETHYLENETETRAMINE
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IN THE LIMELIGHT

★ A NEW YORK BRANCH OF THE PLASTICS INDUSTries Technical Institute of Los Angeles, Calif., will be opened early in 1942, according to an announcement by Francis Gudger, president of the Institute. Dr. John P. Trickey, assistant technical director, is now in New York to install equipment. He will be technical director of the school. Classes will include resident, day and evening courses. Location and opening date of the school will be announced shortly. E. F. Lougee, chairman of the Institute and John Delmonte, technical director will supervise the curriculum.



W. H. MILTON, JR.

★ PLANS FOR THE CONSTRUCTION OF A NEW $1,000,000 plant in Pittsfield, Mass., by the General Electric Co., for the manufacture of synthetic phenol were announced recently by W. H. Milton, Jr., newly appointed manager of the G-E plastics department. This action is being taken at the request of the OPM to counteract the shortage of phenol, a principal ingredient in the manufacture of certain plastics used by the government and industry for the production of a large share of their plastic parts.

The proposed plant, which is expected to be in operation by Sept., 1942, will consist of four structures resembling the layout of an oil refinery. The principal plant will be a single story structure to be situated east of the 1 Plastics Avenue plant.

The phenol plant is the outgrowth of a pilot plant development which has been conducted in Pittsfield for the last two years, under the direction of Dr. G. F. D'Alelio, director of the General Electric plastics department laboratory. It is expected to produce about 75 percent of the department's present requirements for this material.

Mr. Milton succeeds G. H. Shill, who becomes assistant to the manager of the appliance and merchandise department with headquarters in Bridgeport, Conn. This announcement was made recently by Vice-President H. L. Andrews, who stated that Mr. Milton will have the responsibility for the operation of the company's five plastics factories. Mr. Milton joined the plastics department in 1938, transferring from the company's Philadelphia plant where he was a specialist in the power and mining department. In 1940 he was named assistant manager of the Plastics department, a position he held until his present promotion. He is a native of Roanoke, Va., and was graduated from Virginia Military Institute, in 1920.

★ NEGOTIATIONS FOR THE CONSTRUCTION OF A $2,200,000 plant to produce chemicals needed in the manufacture of synthetic rubber was recently announced by Charles Belknap, executive vice-president of Monsanto Chemical Co. The plant to be constructed in the vicinity of Galveston County, Texas, will be built under a lease arrangement between Monsanto and the Defense Plant Corporation, an RFC subsidiary. On completion title will be retained by the Defense Plant corporation.

★ AN ASBESTOS MILL CAPABLE OF PROCESSING large quantities of asbestos-bearing rock is now under construction on the Johns-Manville properties in Chrysotile, Arizona. The new mill will be in operation early in 1942, and will at that time add substantially to the supply of asbestos fiber available in this country to meet defense manufacturing needs. The asbestos fiber found at Chrysotile is particularly valuable in the manufacture of filters, woven asbestos materials, asbestos paper, many types of asbestos-cement products, and as fillers in asphalt tile and plastics molding compounds.

★ BUSHROD E. WILSON HAS BEEN APPOINTED SALES manager of Plastic Inlays, Inc. He has been transferred from the Detroit, Mich., office to the main office in Summit, N. J.

★ ROBERT G. DAILEY, FORMERLY SALES ENGINEER of the Firestone Co., has taken the place of L. T. Barnette as sales manager of the Thermo-Plastic Division, Standard Products Co., Detroit, Mich.

★ BAKELITE CORP., UNIT OF UNION CARBIDE AND Carbon Corp., 30 East 42nd St., New York, announces the appointment of J. Walter Guyer and J. S. Whitaker to the Research and Development Staff at Bloomfield, New Jersey.

★ D. ROBERT YARNELL, MECHANICAL ENGINEER of Philadelphia, Pa., was presented the Hoover Medal at the annual meeting of The American Society of Mechanical Engineers, held in New York City, December 1 to 5.

Mr. Yarnell did outstanding work as a member of the mission that fed German children at the end of the last war. He is now aiding refugees in this country and Europe.

★ ERIE RESISTOR CORP., ERIE, PA., ANNOUNCES the appointment of Industrial Production, Inc., 738 East Third St., Los Angeles, Calif., as its representatives.

★ THE COMPRESSED AIR INSTITUTE ANNOUNCES A nation-wide contest for industry, scheduled to start Dec. 1, 1941. The contest is to continue for 6 months, closing June 1, 1942. Fourteen cash awards will be given. These comprise a first prize of $100; three $50 prizes and ten of $25, and as many additional awards of $25 as there shall be contestants who submit material acceptable for use in technical journals. Virtually no restrictions are placed upon the eligibility of contestants. Nor is the subject matter of their presentations limited other than it be concerned with some use or phase of compressed air.

★ CELLULOID CORP., 180 MADISON AVE., NEW YORK City, merged on Dec. 5, 1941, with Celanese Corp. of America under whose control it has operated since 1927. The company will be known as the Plastics Division of Celanese Corp. of America.

★ THE DURANOL DIVISION OF JOSEPH H MEYER Bros., manufacturers of plastic and plastic-and-wood displays, have moved from 389 Fifth Avenue, New York City, to 63 Tiffany Place, Brooklyn, N. Y., where they have opened a new factory and executive offices. The showroom will remain at the Fifth Avenue address.

(Please turn to next page)

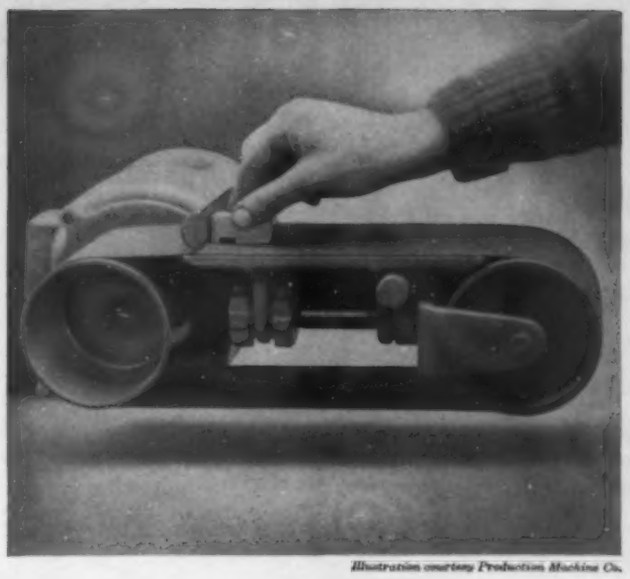


Illustration courtesy Production Machine Co.

What Coated Abrasive Has More Keen-edged Grains?

CLOVER, of Course!

When your skilled mechanic uses a piece of Clover Coated Abrasive, he can tell *in a flash* that he is getting sanding at its best. His trained hands quickly detect the super-cutting power in Clover's husky, perfectly graded, keen-edged grains. Your mechanic's job is done with speed and precision when he uses a Clover Coated Abrasive.

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WE CAN HELP YOU!

Clover Abrasive Advisory Service is ready to help you untangle your sanding problems and make recommendations that will put your production on an economical basis. Write DEPT. M for details. Ask us also for informative Abrasive Manual, and for our free trial offer.

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ASK, ALSO, ABOUT CLOVER GRINDING AND LAPPING COMPOUND —FAMOUS FOR 38 YEARS

In the 38 years Clover Compound has been the first choice of expert machinists for precision lapping, over 40 million cans have been used,—each can demonstrating these long-famous Clover qualities • Perfectly graded, super-sharp, diamond-hard Silicon Carbide grain • Eight grades from microscopic fine to very coarse • Special heat-resisting petroleum hard oil binder • Withstands friction temperatures • Maintains uniform consistency and grain suspension • Fast-cutting • Cool-cutting • Does not burn work.



The trade mark that certifies abrasive quality

CLOVER
Coated Abrasives
Easily Identified by Color-Striping and the Famous Clover Trade Mark

QUALITY ABRASIVES SINCE 1903



Here are many plastics, many shapes, contours and sizes. Here, too, is visible evidence of marking versatility.

There are *five* Markem methods. All are *modern*. Each produces work *better, faster* or *at less cost* than mold marking or hand marking.

For the application of these methods there are many models of Markem Plastic Printers. These machines utilize type and plates designed for fast set-ups in simplified holding devices. Used with work holding fixtures, incredibly fast changes are made possible to facilitate production where short runs occur.

Equipments are almost *custom-made* to individual requirements. It is important to you that we have specifications or complete details of your problem.

Samples, if available and sent to us, are marked and returned with recommendation of method and equipment for duplicating our work in your plant. If inquiry concerns defense, please state applicable priority rating.

MARKEM MACHINE CO.
60 Emerald St. Keene, N. H.

National defense news

★ ALTHOUGH THE BAN ON CELLOPHANE AND OTHER similar transparent materials from the Office of Production Management, Division of Priorities, may be changed or revised in the near future, the following digest of the order, issued November 8, 1941, is of current interest. Authentic revisions or interpretations will be published as soon as they are received.

Gift wrappings, soda straws, cosmetics, soaps, and hardware are a few of the items affected by the order issued by Donald M. Nelson, Director of Priorities. The order was drafted by the Division of Civilian Supply.

The order permits suppliers and their customers to use up existing stocks under certain conditions. Thereafter, these transparent materials cannot be used to package or manufacture products in the following categories:

Razor blades, cosmetics and soaps, textiles, rubber and rubber products (except for use as a substitute for holland cloth in the backing of retreading stocks for tires), hardware, metals and sporting goods, paper and paper products, laundry, candles and wax products, electrical equipment (except its manufacture) and decorations and novelties, including molded paper hats, molded Christmas bells, molded flower pot covers, bows and rosettes, flowers, wreaths and garlands, soda straws, ribbons, household rolls and gift wrappings.

Users are given 60 days to exhaust stocks now on hand. Suppliers who have already prepared stocks for customers in such a way that they could not be used by persons unaffected by the order are allowed the same time for disposal.

Suppliers were ordered to notify their regular customers of the terms of the order. Failure to give notice, however, will not excuse any customer from compliance.

Large quantities of chlorine, phenol and glycerine, scarce chemicals vital to the defense program, are used in making cellophane and similar transparent materials.

Further studies are being made by the Division of Civilian Supply with a view to extending the curtailment to the packaging or manufacturing of food and tobacco products. Substantial savings already have been made in elimination of scarce materials from the packaging of cigarettes. The thickness of the tin foil used as a wrapper has been halved, thus freeing for the defense program an estimated 16,000 tons of lead and more than 400 tons of tin a year.

★ IN A MOVE TO BROADEN THE ASSISTANCE already extended to research laboratories, the Priorities Division has issued an order assigning a preference rating of A–5 to acquisition of the scarce materials required by manufacturers of the necessary laboratory chemicals and equipment. The order is effective immediately. Producers who supply laboratories engaged in research, testing, analysis and in plant control studies, as well as clinical and academic (college and high school) laboratories, are covered by the order. The rating is applicable to material required for packaging the equipment for delivery, as well as to those elements entering into its manufacture.

★ THE PLASTICS OFFICE ORIGINALLY OPENED IN Washington, D. C., in the OPM Ordnance Branch, has been transferred to the Bureau of Industrial Conservation, Division of the Materials Branch, OPM. The new location for this office will be in Temporary E Building. Mr. G. Holmgren of Chicago will be director of the division.

★ A CLINIC ON THE CONSERVATION AND RECLAmation of Materials used in Industry was held at the Hotel Astor, New York, N. Y., on Tuesday, December 2, as a special feature of the 1941 Annual Meeting of The American Society of Mechanical Engineers, 29 West 39th St., New York, N. Y. R. M. Gates, president, Air Preheater Co. headed the committee which planned the Clinic.

★ IT WAS RECENTLY ANNOUNCED BY THE OPM that there are new restrictions designed to increase supplies of second cut cotton linters for production of smokeless powder and plastics. In an amendment to the preference order covering cotton linters, the OPM ordered that no deliveries of second cut linters shall be made except to plants engaged in the chemical industry in the United States, its territories and the Philippine Islands. These linters may only be used for production of purified cotton linter pulp, the OPM order declared.

The amended order also states that no mill making more than one delinting of cottonseed may produce more than 20 percent of its output in first cut linters. Deliveries of run-of-the-mill linters to non-defense plants are limited to 20 percent of the total produced in any month.

Provision was made to permit delivery of cotton linters of any grade under contracts entered into prior to July 31; to permit delivery of No. 3 grade under contracts entered into prior to Nov. 5; and to permit delivery of imported second cut linters under contracts entered into between July 31 and Aug. 30.

★ THE SOCIETY OF THE PLASTICS INDUSTRY ANnounces that the following meetings have taken place under its auspices: Meeting of extrusion and injection molders at the Hotel Pennsylvania, New York, December 1, to discuss allocations. General New England States plastics meeting, Hartford, Conn., Dec. 2, at the Hotel Bond; Plastics Materials Manufacturers Meeting with OPM on Thermoplastics, Washington, D. C., Nov. 25 and a Plastics Molders' Committee Meeting with OPM officials, Washington, D. C., Nov. 18, to discuss material shortages and priority regulations.

★ AN IMPORTANT PART OF THE U. S. NAVY EXPERImental program in testing materials is the recent contract given for 14 experimental gliders, including four large troop-carrying ships built of wood-impregnated plastics. Two of the gliders will replace 24-place ships, and the other two will be 12-place crafts. Ten small 2-place training gliders will also be built for the Navy. Plastics to be used have undergone extensive tests, it is said. Chief advantages: light, durable, easily worked and will not pick up moisture or fungus growth. Further, they are easily repaired and maintained, since breaks may be "cold-patched" on the field or "hot-patched" in the shop.

★ SINCE COPPER IS UNDER STRICT ALLOCATION through a ruling of the Office of Price Administration and Civilian Supply, Dow Chemical Co., Midland, Mich., announces a flexible semi-transparent tubing of thermoplastic vinylidine chloride available to industry as an alternative for copper and other metal tubings. This tough, chemically resistant tubing is suggested by the company for applications previously demanding copper except for high temperatures and very high pressures are met.

★ THE UNITED STATES GOVERNMENT HAS PROvided more than $1,000,000 for current research to aid American scientists in developing high-speed plastics-and-wood fighting planes. In the opinion of both Major General H. H. Arnold, chief of the Army air forces, and Henry L. Stimson, Secretary of War, wooden strips impregnated with synthetic resins and molded into high pressure to a smooth infusible mass of high strength are a definite possibility as construction material for combat aircraft. Rear Admiral John H. Towers, chief of the Navy Bureau of Aeronautics, also believes there should be "accelerated progress" in research concerning the use to which wood and plastic-impregnated plywood can be put in modern warplane building.

★ A NEW RUBBER DERIVATIVE WHICH CAN REplace aluminum now used in the fuel tanks of planes and combat vehicles, providing greater protection against fuel leakage caused by bullet punctures or crashes, was announced recently by P. W. Litchfield, Chairman of the Board of The Goodyear Tire & Rubber Co. The new product, named Plioform, was developed in the company's research laboratories at Akron, Ohio.



Two HANDS ARE BETTER

The expert in any field seldom leaves anything to chance. He uses both hands—even though he might get along with one. And that's the way it is with molding plastics. We bring our full experience and plant facilities to bear on the simplest problem—one of the reasons why our customers are satisfied with the work we do for them.

American Insulator Corp.

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Plastic Molds

FOR

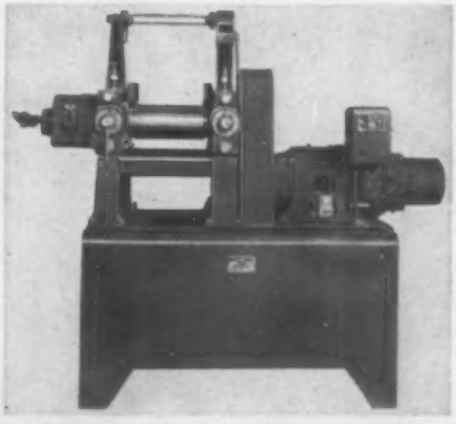
INJECTION
COMPRESSION
TRANSFER } Molding

We are thoroughly equipped, staffed and experienced to design and build molds for all modern molding processes: injection, compression and transfer. For 20 years we have served successful custom and proprietary molders. Consult our engineers.

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Manufacturing Company

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A LABORATORY MILL *Designed* For The PLASTIC INDUSTRY



6 x 12" MILL With Geared Head Motor.
Other Standard Sizes Also Available.
Write for Prices and Specifications

WM. R. THROPP & SONS CO.
TRENTON, N. J. EST. 1888

America's Modern Plastics Exposition

Department store show tours country









A COMPLETE, informative, educational exposition which presents the story of plastics with all the showmanship of good theater, yet simply enough so that the average consumer may understand the fundamentals of the plastics industry, is scheduled for showing at the J. L. Hudson department store, Detroit, Mich., from Jan. 12 to 31, inclusive.

America's Modern Plastics Exposition is organized and routed to leading department stores throughout the country by W. L. Stensgaard and Associates, Inc. During the early part of September, the Exposition was on view at the J. N. Adams store, Buffalo, N. Y. From there it went to Jordon Marsh Co., Boston, Mass., and then to Hudson's. From Feb. 16 to March 9, inclusive, the Exposition will be on view at Stix, Baer and Fuller, St. Louis, Mo. The Exposition has made the rounds of leading department stores since May of this year.

Since the advent of the national defense program, and the subsequent publicity given to the Government's growing use of plastics, the public has become increasingly curious about materials and their applications. Public opinion no longer consigns plastics to the laboratory. The question, "What are plastics?" is asked every day. This exhibit is the answer to the persistent query in terms that the average man can understand.

The exhibit was two years in the making. Stensgaard Associates, in cooperation with MODERN PLASTICS magazine, conceived the idea of giant shadow boxes, 4 ft. high overall by 8 ft. long and 17 in. deep, which would tell the story of plastics. These units were divided into various categories, among them: Machinery and Appliances, Radio and Communications, Aviation and Transport, Lighting, Decorations, Photographic and Musical, Home Furnishings and Housewares, Plastics in Homes and Buildings of the Future, Sporting Goods, Games and Toys, Business and Office Equipment and Cosmetics and Decorations. In conjunction with the exhibit, a 35-minute Kodachrome sound motion picture, "The Magic of Modern Plastics," is shown daily.

As the 16-mm. film unrolls, the public is taken "back stage." They learn of the phenomenal growth of the industry since the early days when John Wesley Hyatt searched for a new and cheaper material for the manufacture of billiard balls. From the earliest beginnings in the laboratory to the various processes of manufacturing the story is deftly told. Design, fabrication, finishings—all the steps leading to the sale of the actual merchandise across the counter to the ultimate consumer are explained in a running commentary.

Some of the interesting features in the Exposition are a group of biological specimens, lent by the United States Government, mounted in solid acrylic blocks; America's No. 1 Glamour Girl, Miss Plastics, a full sized, hand carved mannikin completely clothed in plastics from her transparent bonnet to her fancy slippers; a group of photographs, and quoted statements from nationally known figures on the future of plastics.

Department store executives report that thousands attend the Exposition weekly. They represent an intelligent, interested group from each city and it has been observed that, for the most part, they have fallen into the following categories: school teachers and their students, business men, industrialists, art gallery directors, designers and housewives.

Messages of congratulation are received by the Exposition wherever it is shown. Among them are letters from Charles F. Kettering, vice-president of General Motors Corp., and Glenn L. Martin, president of the Glenn L. Martin Company.

Photographs on this page represent typical displays set up in the department stores where America's Modern Plastics Exposition has been shown thus far. Window displays showing the use of plastics in Fashions and Homefurnishings are an important part of the promotion program

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} ALL PLASTICS

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PLASTICS DIVISION
202 DIAMOND STREET BROOKLYN, N. Y.

PLASTIC MOLDING
at its best



Never unwilling to investigate the possibilities of any job, we are always ready to give you an honest opinion as to whether YOUR problem can be solved by Plastics or not.

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Production of plastic teeth

(*Continued from page 45*)

The tooth form is carved first in plaster. In most instances extracted natural teeth are used as models. From the plaster carvings a plaster model, with the complete set of teeth assembled, is made. From this, a foundry matrix is prepared. The phospho–bronze master pattern is poured and then fitted and cut so that the original plaster carvings precisely fit in the mold cavities. From the master pattern countless duplicates can be made in the same manner. These are then nickel-plated or chromium-plated to give the plastic artificial tooth a highly polished surface.

The packing of the molds with powder is an art in itself. Maintenance of proper blend from the neck of the tooth to the incisal tip is the objective that the operator must keep in mind. Molds, packed with dry powder are now placed on a pre-heated plate or grill where they remain until the material acquires a certain degree of plasticity and the acrylic particles have started to adhere. Between this step and the actual compression molding, the packed molds are placed in a storage oven. They are then removed to a press composed of electrically heated platens controlled to an accurate degree. It has been found that 800 lbs. per sq. in. pressure is sufficient to give desired results. A great increase of pressure is not only unnecessary, but may also be detrimental to the finished product. After removal from the press each mold is placed in a small hand clamp and quenched in warm water.

The plastic teeth are then removed from the mold; flash trimmed off, and the teeth inspected. Any defective teeth are discarded. Full sets are assembled.

Credits: Material: Röhm & Haas Co. Denta Pearl teeth: Designer: E. Byron Kelly, D.D.S., and Frank Slack, D.D.S., in conjunction with research staff of H. D. Justi and Son, Inc. Molds and special equipment, H. D. Justi and Son, Incorporated

Resistance to chemical reagents

(*Continued from page 66*) effect of chemicals on some plastic materials.

Information regarding the physical appearance of the plastics after immersion in the various chemicals is presented in Table IV. Many evidences of attack not revealed by changes in weight or dimensions are listed in this table. Various specimens illustrating the effects produced by the reagents were selected for photographing. These are shown in Fig. 1. Edge discoloration of the paper-base laminated phenolic plastic, delamination of the urea-formaldehyde specimen, warping of the vinyl butyral and casein materials, and pronounced shrinkage of cellulose acetate plastic when dried after immersion in certain reagents are among the phenomena illustrated.

A final word of caution may be desirable in order to avoid misinterpretation of the information contained in Tables II, III and IV. Effects which do not become prominent in a 7-day immersion period or a subsequent 4-week reconditioning period may under conditions of service bring about relatively rapid deterioration of the plastics. This is particularly true for the plastics immersed in strong acids. Thus, although cellulose nitrate plastic is indicated as unaffected by the 7-day immersion in sulfuric, hydrochloric and nitric acids, the presence of the free acid in this plastic will accelerate its decomposition. Another precaution to be observed is in using the data for guidance in applications involving contact successively with various chemical reagents. Cellulose nitrate plastic is relatively unchanged in appearance by a 7-day contact with 10-percent nitric acid and carbon tetrachloride, respectively. However, if the sample of cellulose nitrate which has been dried in air for 4 weeks after immersion in 10-percent nitric acid is kept for 7 days in carbon tetrachloride, it swells, develops blisters, and becomes markedly discolored. Although this is an extreme example, it illustrates the difficulties that may be encountered unless adequate tests are made with plastics under the actual conditions to which they will be subjected in service.

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Textiles from casein fiber

(*Continued from page 39*) through spinnerets under hydrostatic pressure, the emulsion emerges as thousands of strands of fiber, called "wet tow." After many other treatments, it becomes soft and luxurious. It can be cut into almost any desired length—from a half-inch piece to a half-mile fiber.

Despite the amazing strides already made, there are still problems, according to Thomas H. McInnerney, board chairman of the company. Chief among them are to find some use for the whey left after the casein is extracted from the skim milk. It takes 100 lbs. of skim milk to make 3 lbs. of casein, so the quantity is considerable. The firm intends to "drive ahead until the problem has been wholly solved."

Credits: "Aralac," manufactured by The National Dairy Products Corp. for Aralac, Inc., Research: Atlantic Research Associates Inc., a scientific division of The National Dairy Products Corp., conducted under the direction of Francis Clark Atwood. Improved casein provided by Sheffield By-Products for laboratory experiment

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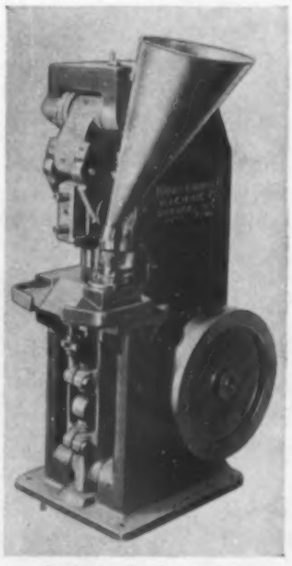
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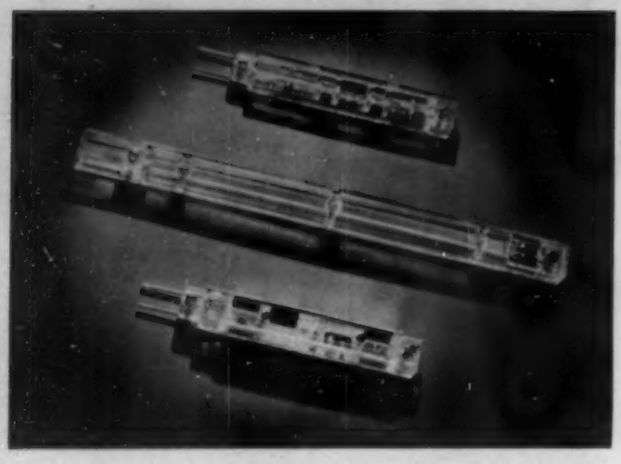
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Plastic housings provide advantages of lower initial cost; rapid assembly or installation; simple disassembly and reassembly when production lines are changed

Sectional wiring system

(*Continued from page 35*) to rewire these structures in order to provide proper capacity for the increased needs of lighting. In the majority of these buildings, particularly those that are fireproof, wiring systems have been installed in conduits which are embedded in the physical structure. If capacity had to be increased by conventional methods it would mean tearing out undersized conduits.

A little over a year ago, thin wall or small diameter conductors were made available for the pressing needs of the electrical industry to develop a commercial rewiring market. These improved insulated copper wires can now be installed in existing conduits to replace the present overloaded circuits. Two or three times as much wiring system capacity is possible without the need of expensive replacement of old conduits. Plastic surface wiring requires only 44½ lbs. of plastic material and copper for each 100 ft. of circuit run in a system carrying 45 amperes, as against comparable weights of 476 lbs. for a 45-ampere conventional conduit system with outlets at intervals of only two feet.

The design details incorporated in the sectional plastic wiring system overcome the following deficiences in most conventional methods: grounding to metal enclosures; current limited by insulating coverings; difficulty of providing adequate outlets; undersized copper; poor electrical joints at outlet boxes and devices; and insufficient mechanical protection of electrical conductors.

Plastic housings provide these advantages: lower initial installation cost; rapid assembly or installation; simple assembly and reassembly when production lines are changed; equivalent electrical facilities with reduction in the volume of essential materials.

Advantages of surface wiring

Some suggested applications for surface wiring are above kitchen work tables, mounted as chair rails, on factory benches, for office or home mounted under window sill, embedded in plaster and on baseboards.

Credits: Bakelite phenolic, molded by Bridgeport Moulded Products, Incorporated

Plastics from waste products

(*Continued from page 72*) ing under pressure were all studied and all gave good results.

It was concluded that the best plastic of this type was produced as follows: 1 part concentrated sulfuric acid was dissolved in an equal weight of water and mixed with 10 parts phenol or cresol and 14 parts of corncobs or oat hulls. This mixture was cooked at 90 lbs. steam pressure for 2 hours, dried at 100 deg. to 120 deg. C. for 8 to 10 hours and ground to 10 mesh. It was molded at 220 deg. C. and 2000 lbs. per sq. in.

The material produced in the preceding manner was dark brown or black. It contained some unreacted cob material but no added filler. Although it compared favorably with similar commercial materials in strength, the water absorption was rather high. In an attempt to lower the moisture absorption the amount of cobs was reduced from 14 to 3 parts, thus producing a resin in which all the cob material was dissolved. This resin was mixed with an equal weight of wood-flour filler before molding.

When made in this manner the resin contained an excess of phenol or cresol which lowered the melting point so that the powdered material sometimes ran together into a plastic mass at room temperature. The effect of cresol on the melting point was shown by making a series of batches in which the ratio of cresol to cobs was varied from 1.5 to 2.1 while the cob-acid ratio was held constant at 8. The temperatures at which powdered resin from these various batches would run together were determined. Over the range of ratios tested the temperature varied directly as the amount of cresol. Plastics containing the higher amounts of cresol were not so strong nor so water-resistant as those containing the lower amounts.

The excess cresol could be removed by boiling either at atmospheric pressure or under vacuum. It was found that the cresol removed by vacuum distillation, while not pure, could be substituted in the following batch in place of an equivalent amount of fresh cresol. This was shown in a series of 6 batches in which cresol from one batch was used in the next succeeding one. Recovery amounted to as much as 55 percent of the original cresol.

Improved process for producing a plastic from corncobs

By designing a cooker in which the material was constantly scraped away from the sides and bottom to prevent local overheating, a process of cooking under pressure requiring about 45 percent less cresol was developed. The procedure used was as follows: 11 parts of cresol, 7 parts of cobs, and 2 parts of sulfuric acid (sp. gr. 1.36) were heated in the cooker until the vapors could be seen issuing from the outlet. The valve was closed and the temperature raised to 165 deg. C. The

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pressure was held at 35 lbs. per sq. in. for 1/2 hour, bleeding off excess vapor where necessary to prevent a pressure rise. The pressure was then released and the temperature of the mixture raised to 225 deg. C. to remove the excess cresol.

Filler was originally mixed with the powdered corncob resin in a ball mill using only a few balls to reduce grinding action to a minimum. This procedure gave good results. It was later changed to a process of mixing the filler with the melted resin in a Banbury mixer to conform more nearly with commercial practice. The strength of the finished piece increased with the addition of asbestos filler up to 70 percent by weight and with wood-flour up to 60 percent. Experience showed that it was not practical to use more than 60 percent asbestos or 50 percent wood-flour because of the difficulty in molding a product free from specks of filler.

The moisture absorption of the plastic with asbestos filler was as low as 0.02 percent in 48 hours. Samples kept under water over 2 years retained their original appearance. The strength was tested by dropping a 5-lb. weight on a peen-ended 1-in. rod resting on a 1/4-in. thick disk of the material. The weight was dropped first from a height of one inch and then from heights successively greater by one inch until the specimen was broken. With asbestos filler heights as high as 13 in. were required to produce failure. Molding was done at 150 deg. to 200 deg. C., depending on the final temperature in cooking the corncob resin, and at 3000 lbs. per sq. in.

The plastics thus produced were thermoplastic. When hexamethylenetetramine was added to react with any excess cresol, a thermosetting product was obtained. When added to the powdered corncob resin and asbestos filler in the ball mill, only 3 percent of hexamethylenetetramine was necessary. When using the Banbury mixer, it was necessary to keep the mixing temperature below 135 deg. C. to prevent the formation of a thermally hardened product in the mixer. This made use of a corncob resin of lower melting point necessary. It was readily produced by heating the resin after cooking to only 190 deg. C. instead of 225 deg. C. However, because of the excess cresol, such a resin requires a considerably greater amount of hexamethylenetetramine. The larger quantity of cresol consumed in making the resin and the increased amount of hexamethylenetetramine required make this plastic more costly to produce.

It was found that furfural could be substituted for part of the hexamethylenetetramine. The following mixture gave satisfactory results: 400 parts of corncob resin, 38 parts of hexamethylenetetramine, 30 parts of calcium hydroxide, 24 parts of aluminum stearate, 500 parts of asbestos filler and 90 parts of furfural. All ingredients, except the asbestos and furfural, were processed in the hot mixer until the resin was melted. The asbestos and furfural were mixed together and added. The mass was then processed in the mixer for 4 minutes at slow speed and dumped out to harden before grinding it to a powder suitable for molding. Thermosetting plastics were molded at 190 deg. C. for 3 min. at 3000 lbs. per sq. in. pressure.

Material costs

The raw material costs of the plastics are estimated as follows:

Thermoplastic material:	
700 lbs. corncobs at 1/2 cent per lb.	$ 3.50
920 lbs. cresol at 10 cents per lb.	92.00
76 lbs. sulfuric acid at 1 cent per lb.	0.76
Total resin cost (raw material only), 1100-lb. yield	96.26
1650 lbs. asbestos filler at 1 cent per lb.	16.50
Total (2750 lbs.)	112.76
Raw material per lb.	0.041
Thermosetting material:	
400 lbs. corncob resin at 8 3/4 cents per lb.	35.00
38 lbs. hexamethylenetetramine at 34 cents per lb.	12.92
30 lbs. calcium hydroxide at 1/2 cent per lb.	0.15
24 lbs. aluminum stearate at 19 cents per lb.	4.56
500 lbs. asbestos at 1 cent per lb.	5.00
90 lbs. furfural at 10 cents per lb.	9.00
Total (1060 lbs.)	66.63
Raw material cost per lb.	0.063

All-American bounce

(*Continued from page 47*) raw material is checked until the ball itself is finally measured. Raw material is drawn up into two separate hemispheres and their edges prepared before they are made into a preform. During this assembly, the preform is chemically treated and then put into rotating barrels until ready to be put into a soak for seasoning. The preforms are then molded under pressure. Molds for this operation are very delicate and require masterful handling as the slightest mar will put the mold out of register, causing the ball to be out of round and off-balance. Molds receive daily inspection and are "trued up" every few weeks. The molded ball is then returned to soak until set for further handling. It is then put in cleaner and finishing barrels for that velvet finished surface.

After the ball has seasoned under a specified temperature, it is inspected for roundness and seam. The official ball goes on to further inspection for diameter check, width of seam, weight of between 37 and 41 grains and counterbalance to eliminate wobble in play. Its tensile strength and fracture flaws are constantly watched. It is then printed, packaged and ready for delivery. Entire time consumed, including waiting periods for soaking and seasoning, is 5 weeks.

When this American ball was first presented, it was an innovation to the trade as, heretofore, all table tennis balls were imported. After a steady campaign, the trade was convinced that a table tennis ball could be produced in this country which was comparable to, or better than, the imported ball upon which they had been dependent.

Credits: Manufactured by Louis Sametz, Inc. Material furnished by Nixon Nitration Works.

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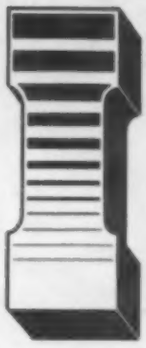
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Fan blades for cooling towers

(*Continued from page 46*) pressure, heat and time required to insure bonding; specific gravity desired, tensile, compressive, bonding and shearing strengths. The design and machining of a suitable mold was the next difficulty. Because of the length of the blade and its peculiar shape, the mold required such a large piece of steel that there was fear it would distort during hardening. Consequently, a heat-treated steel which could be machined was selected; one with sufficient compressive strength to stand up without hardening.

In testing the various woods, it was found that the greatest strength was obtained from red birch, but when poplar was properly impregnated and pressed, there was such a slight difference in strength that it was chosen. Other factors were ease of handling and low cost.

Of the many methods tried for impregnating the material with the varnish, the vacuum method proved most satisfactory because a very quick impregnation was possible. It was also determined that the impregnated veneer, in order to give the most satisfactory operation in assembling and pressing, had to be dried to a very accurately controlled "squeeze-out" of the resin, and that the volatile content had to be very carefully maintained. It was necessary to pre-treat the pieces of veneer to this condition by vacuum. After the pieces had reached the proper state, they were kept in an air conditioned room so that the volatile content would not change more than one-half of one percent before assembling.

Forty-one pieces are used in each fan blade. The assembled fan is placed in a blade warming oven in order to soften the resin. It is then given a preliminary forming to start the necessary twist in the material and is held in this preformed position while it cools and takes a set. The partially preformed blade is then inserted in the heated mold and pressure applied gradually so that the material will become plastic before taking the exact shape of the mold. Full mold pressure of approximately 1700 lb. per sq. in. and steam pressure at 70 lb. per sq. in. is applied for a period of approximately three hours, to thoroughly set the resin. After the steam is shut off, water is admitted to the mold to completely cool it before pressure is released; cooling process requires approximately $1^1/_2$ hours.

A close-up of a section of the resin-bonded, molded-laminated fan blade showing the enormous size of the blade



The molded surface layer of the blade is of cotton duck impregnated with phenolic resin. This gives a uniformly smooth surface and even color. Blades are securely fastened in the hub by the cylindrical projecting end of the blade which is threaded for a $2^1/_4$ in. brass nut. The fan operates at approximately 360 R.P.M. which gives a peripheral speed of 2.5 miles per minute at the tip of the blade.

Tests conducted demonstrate that the new blades deliver the same volume of air as aluminum blades formerly used by the fan manufacturer for the same service. Distortion of the blade due to air pressure is very slight, and so uniform, that there is no "flutter" in the operation.

Credits: Material: molded-laminated Textolite. Developed by Plastics Dept., General Electric Co., for Foster Wheeler Corporation

Injection molded telephones

(*Continued from page 33*) substances now in production were chosen. A few of these factors were wall thickness, location of sprues, flow lines, welding areas, position of bosses, heat, pressure and color. Models were tested for reaction to heat and cold, ability to withstand wear and simulated aging processes and breakage. The telephone is at the same time a universal and a precision instrument. It must serve everywhere, and its performance must be unquestionably reliable.

After long periods of research, engineering and testing, production engineers were asked to start "pilot" production. Although thermoplastic housings were on a definite scheduled delivery as early as January of this year, engineers continued to work in research.

Today, because of metal shortage, production of plastic housings has been speeded. The alloy used in the manufacture of the great majority of combined set housings is composed largely of zinc, with minor percentages of aluminum and magnesium. Because all three are now "critical" metals engineers immediately set to work to see what could be done to relieve use of those metals in telephone construction, thus relieving them for vital defense production. Evidence of their success is that about one-third of the combined sets now in production at one branch are of plastic composition. Marked "plastic," these sets now go out unobtrusively with the rest of the instruments.

The present limited production of plastic telephone set housings hardly points to a complete replacement of metal. It is true, however, that for the duration, and indeed, for any long range view, plastics will have played an important role in the consistent progress and development of vital medium of communication.

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Advice to the molder

(*Continued from page 34*) laboratory tests which endeavor to reproduce universal service conditions, unlimited field trials may bring out the necessity for slightly different materials and even revisions in design.

Government procurement agencies are usually very fair in their appraisals of quotations on development orders. They appreciate the fact that experimental dies and the production of test parts are costly and that the experience and ingenuity of the vendor is represented in the project.

This difference in governmental procedure, therefore, demands that *all* experimental and development expense be covered in the educational and sample orders so that the final production price will be strictly competitive as submitted.

Sub-contracts

Selling sub-contract parts to industrial firms holding prime or sub-contracts is almost identical to selling industry a commercial application; and unless governmental approval is necessary, which is very rare, will result in more prompt action. If it is necessary for you as a molder to secure defense work in order to obtain material on priorities and maintain your business, concentrate on the prime or sub-contractors. Study the type of equipment they are building for defense and the parts used. Then determine whether or not you have a suitable material and can practicably design plastic parts which will be not only functionally but also economically sound.

Industry has been educated and is susceptible to replacements and substitutions. In fact, industrialists were literally pushed into the plastics substitution program a year ago, due to the shortage of metals, both actual and anticipated. Take advantage of these facts in the broader sub-contract field. It will be easier for your salesmen because it is identical with the solicitation of good sound commercial work. Furthermore, such contacts will be invaluable after the emergency is over and may lay the foundation for continuous industrial plastics work.

New equipment is constantly designed and built for defense purposes. If plastics are to take their rightful place in the program, it is up to the molders to develop and sell better parts. Do not be alarmed by the material supply situation as it pertains to defense work. For example, when aircraft demanded more aluminum than was available, additional plant production facilities were planned, and are now in process of construction. Because the production schedule of synthetic rubber demands more than our present supply, additional facilities are being constructed to take care of the increased requirements. If additional production facilities for plastic materials are necessary for defense, they will be provided.

There are still many applications of plastics in defense to be developed that are fundamentally and economically sound. Search for them continuously, carefully and systematically. Should this emergency be of long standing, your efforts will be more than rewarded.

Non-defense business

If you want to solicit business industrially and be more or less assured of materials for molding purposes, the only classification of preference parts in plastics is covered by the M 25 phenol-formaldehyde order. Try to confine your sales activities to parts which will come in the "A" classification. These are important to civilian welfare and may later become an actual part of the defense program from that standpoint.

London mail box

THE following letter and article from Britain was mailed to us by Gilbert T. Beach, secretary of The British Plastics Federation, Ltd., and is presented for the interest of our readers instead of our usual London letter.—ED.

Editor, Modern Plastics.
Dear Sir,

One of the leading industrialists in the United States recently wrote to one of our members and requested that we should refute certain rumours which were prevalent in America that Great Britain was not taking the war seriously.

I am sending you for your kind attention a copy of the report prepared by this Federation, which was sent back in reply and I shall be most grateful if you can give it publicity in your columns.

We in this country are most anxious to reassure the American people that we are taking the fullest advantage of their wonderful assistance and co-operation.

Yours faithfully,
Gilbert T. Beach, Secretary,
The British Plastics Federation Ltd.
11–12, Pall Mall,
21st October, 1941 *London, S.W. 1.*

THE BRITISH PLASTICS FEDERATION LTD.

The British Plastics Federation, the trade organization of the Plastics Industry in Great Britain, was recently advised by a leading American industrialist in Chicago that propaganda was current in the U.S.A., probably from unfriendly sources, that the Plastics Industry and other trades in Great Britain are still producing unreasonable quantities of non-essential articles of the domestic and fancy goods types and, furthermore, are seeking to take advantage of the present situation by entering into competition with the U.S.A. in certain export markets.

The purpose of these insinuations, which undoubtedly emanate from Germany, is of course to mislead the American people into thinking that British Industry is not taking the war seriously, and yet is asking the United States for the maximum amount of assistance in the shortest possible time.

There is no truth whatever in this propaganda. As far as the British Plastics Industry is concerned, the large majority of its members are engaged almost, if not entirely on vital work for the Government and Service Departments, particularly the Ministry of Aircraft Production. So important are these firms to the National Effort that the Ministry of Labour & National Service recently decided to apply the Essential Work Order to the molding powder manufacturing, molding, manipulating and fabricating branches of the Plastics trade, which means that employees of scheduled firms cannot leave or be dismissed except with special permission of an officer of the Ministry of Labour. The aircraft industry has for long fully realized the possibilities of plastics materials and products, and many of the leading aircraft com-

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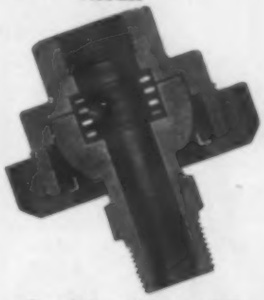
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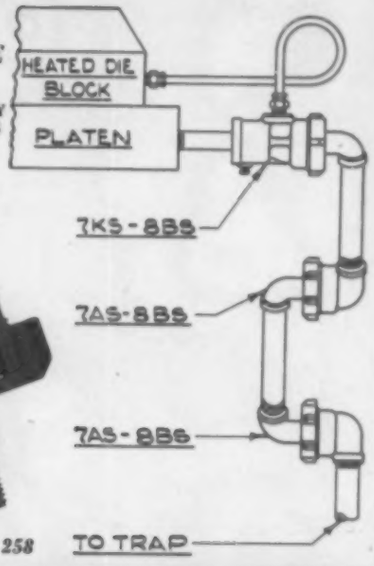
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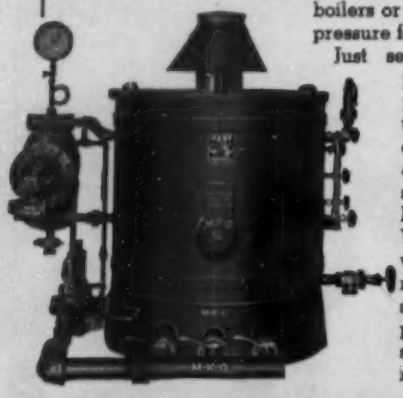
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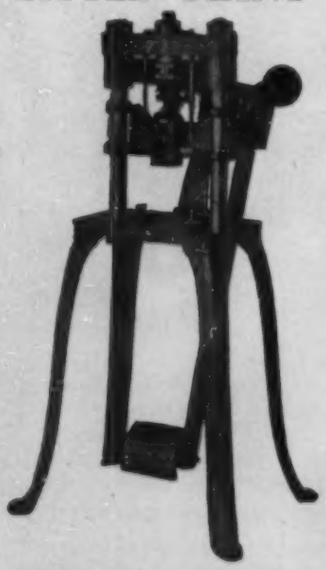
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panies in this country and abroad have actively co-operated in their development. These range from transparent material for cockpit and turret screens and landing-light covers down to molded sections for wings and interior panels and structural units.

The uses to which the Plastics Industry's raw materials are devoted are strictly supervised by the Plastics Control of the Ministry of Supply, to which body applications for licenses have to be submitted; and those firms which, prior to the war, specialized in the manufacture of fancy articles will be found to have switched over completely and perforce to Government and other essential contracts. It is a significant feature of this war that labor simply will not carry out work which is not of national importance, and any plastics manufacturer who endeavored to continue with the production of non-essentials would not only find it impossible to obtain the necessary raw materials, but would be unable to retain his employees. It is becoming increasingly difficult for molders to obtain licenses to employ powders for anything except Government and Service needs; and there is a further control exercised by the Limitation of Supplies Order whereby in the case of plastics fancy and household goods, manufacturers can only produce 25 percent of their pre-war output over a given period.

The Plastics Export Group, which was inaugurated in May 1940, by the British Plastics Federation at the direct request of the Board of Trade, produced a Catalog of moldings suitable for export which is without parallel in this country. Over 400 articles were illustrated and their descriptions given in English, French, Spanish and Portuguese. The British Plastics Industry is concentrating so entirely, however, on the National War Effort that the comprehensive export program initiated by the Group has had to be completely curtailed and placed in "cold storage" until after the war. Fifteen thousand copies of the Catalog and Price List, intended for distribution overseas to specially appointed joint-agents throughout the world, now lie idle and unused and the opportunity has been declined, in the interests of the War Effort of cultivating export markets rendered more open to British development by the blockading of the Axis countries.

The export of British molding powders has also been severely restricted and a license has first of all to be obtained from the Plastics Control. Under this arrangement, orders from abroad can only be accepted when full proof has been given and confirmed by the Ministry of Supply in the country concerned that the powder is required for essential purposes in connection with Great Britain's war effort.

I feel confident that the above remarks are typical in principle of all other industries in this country and indicate, I am sure, that Great Britain has mobilized its resources to the full in her unshakable determination, with the help of the U. S. A., to bring peace, liberty and prosperity back to Europe.

Sorry

★ IT WAS ERRONEOUSLY STATED IN OUR NOVEMber issue that the Koehler Manufacturing Company, Inc., Wheat Rechargeable Battery for the Acousticon and Sonotone instruments for the hard of hearing had a service life of between 50 and 75 years. The service life is between 3000 and 5000 hours.

★ IN THE COLORSITE CO. HONORABLE MENTION award in the November issue, credit should be given Modern Plastics Corp., instead of Modern Plastics Company.

★ THE ACID DIPPER, SHOWN IN OUR OCTOBER ISsue, is used to measure concentrated sulphuric acid and not cream, as it was erroneously stated.

★ THE NEW ADDRESS OF W. L. KELLY IS 111 WEST Monroe St., Chicago, Ill., and not Elyria, Ohio, as it appeared in the November issue.

★ MISS ALICE DONALDSON, DESIGNER, HAS CALLED it to our attention that she was erroneously referred to in the November issue as Miss Dorothy Donaldson.

★ IN THE FYBR-TECH PANEL STORY OF OUR last issue, weight of the panel is 0.2 lb. sq. ft. and not 2 lbs. sq. ft.

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FOR SALE: 1—400 Ton Horiz. Hydraulic Extrusion Press. 1—Hydraulic Scrap Baler, 80 Ton, 6½" Ram, 90" Stroke, 5000 lbs. per sq. in. 2—W. & P. Mixers, Size 15. Large stocks Hydraulic Presses, Pumps & Accumulators, Preform Machines, Rotary Cutters, Mixers, Grinders, Pulverizers, Tumbling Barrels, Gas Boilers, etc. Send for Bulletins #156 and #138, and L-17. We also buy your surplus machinery for cash. Reply Box 439, Modern Plastics.

WANTED: Injection Molding Acetate Scrap or Rejects in any form, including Styrene, Acrylic, Butyrate, Vinyl Resin Scrap materials. Submit samples and details of quantities, grades and colors for our quotation. Reply Plastics, 141 Halsey St., Newark, N. J.

WANTED: Stainless Steel or Nickel Kettle, Vacuum Pan, Hydraulic Press, Preform Machine and Mixer. Reply Box 275, Modern Plastics. No Dealers.

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FOR SALE: WATSON-STILLMAN TRANSFORMING PRESS SOUTHWARK 220 TON HYDRAULIC PRESS. Reply Box 494, Modern Plastics.

WANTED—Reed-Prentice Injection Molding Machine. State size and model number. Scrap grinder Cap. 150 lbs. per hr. Reply Box 475, Modern Plastics.

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WANTED: Injection Molding Acetate Scrap in any form, color, shape—lumps, gates, sprues, etc. Will buy at ten cents per pound. Reply Box 482, Modern Plastics.

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WANTED: Production Engineer for Compression molding. Must have experience of manufacturing, estimating costs and mold construction. Reply Box 491, Modern Plastics.

WANTED: Plant Manager with solid knowledge of plastics and their fabrication, expert machinist, up-to-date on production methods, experienced in designing, able to handle men, age 30 to 45. Write fully stating salary required. Reply Box 492, Modern Plastics.

WANTED late model injection molding machine, preferably 4 oz. Reply Box 493, Modern Plastics.

WANTED—one used 10A Reed-Prentice 2 oz. injection molding machine in good condition. Reply Box 495, Modern Plastics.

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CHEMIST OR CHEMICAL ENGINEER, American, about 30 years of age, with high grade training and several years' experience in resin manufacture, phenolics preferred, for development of adhesives and binders together with intermediates required. An unusual opportunity in a new field. Location Middle West and West Coast. Submit details of education, experience, personal data, salary required, and include photograph. Reply Box 497, Modern Plastics.

AVAILABLE, Creative Designer, willing to combine designing ability with other phases of plastic industry. Nine years' experience in industry, engineering background and 4½ years' art school training, familiar with various uses of plastics. Now employed, but wants position with progressive plastic firm. Reply Box 498, Modern Plastics.

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WANTED: Compression Molds of all descriptions. Also 3 Ball Mills, 5-6 gallon capacity, in good condition. Reply Box 506, Modern Plastics.

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